THIS ISSUE CONTAINS

—numerous features by our regular staff, as well as many exclusive articles by recognized authorities, a few of which are listed below:

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COVER PICTURE

A recently completed cracking unit of Barnsdall Oil Company's Okmulgee, Oklahoma, refinery.

HE ENGINEERING MAGAZINE OF THE OIL AND GAS INDUSTR

The Sharples Process

—

The Processes of Contact Filtration

—

The Gyro Process
of
Vapor Phase Cracking

—

The Samplitt

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The Mixitt

# Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Edited and Circulated Only for Those Actively Engaged in the Operating Departments of the Industry

Volume 2 NOVEMBER, 1930 Number 2


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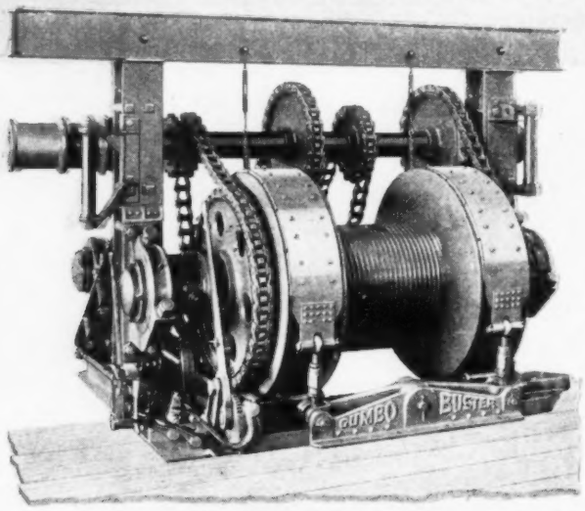


Front and rear views of the Gumbo Buster Heavy Duty Draw Works. Weight 24,150 lbs.—4 speed. Built by AMERICAN WELL AND PROSPECTING COMPANY.

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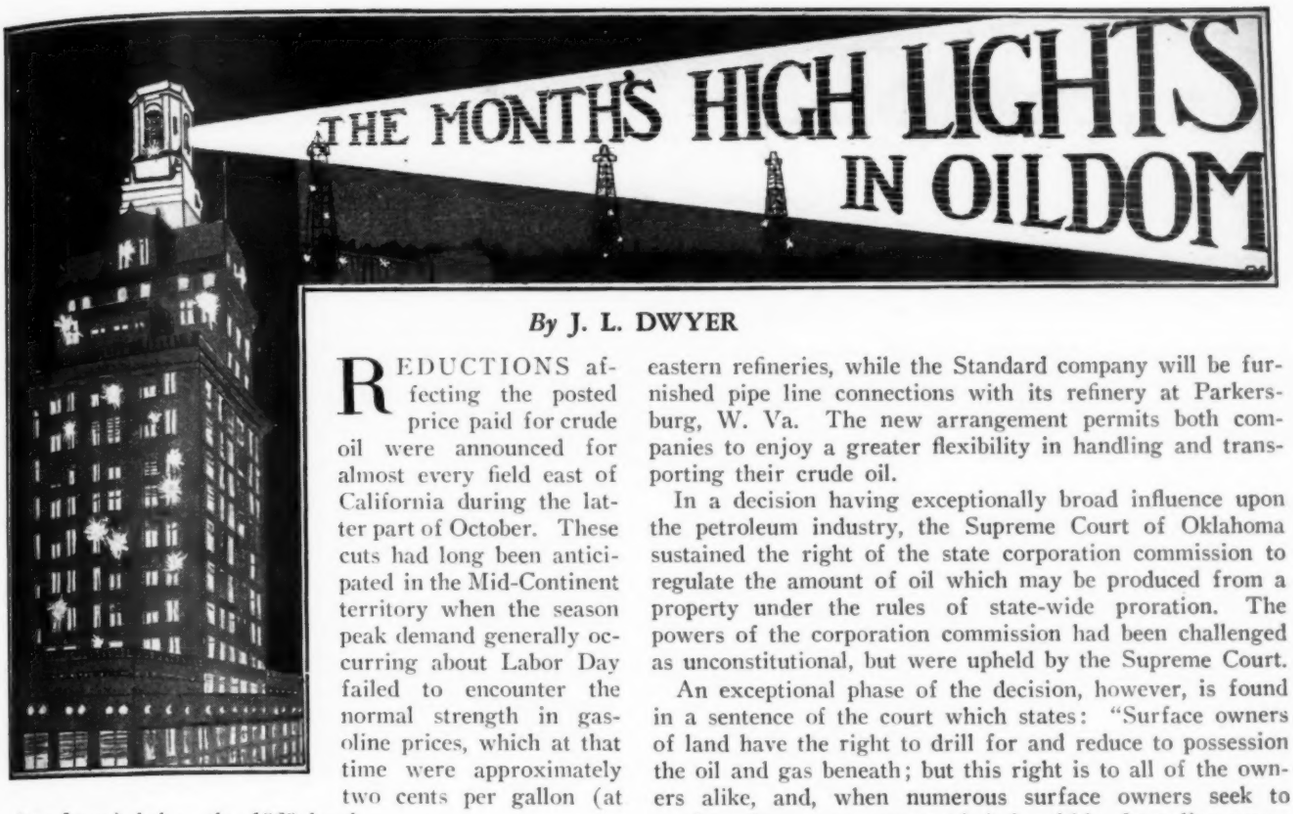



*By* **J. L. DWYER**

REDUCTIONS affecting the posted price paid for crude oil were announced for almost every field east of California during the latter part of October. These cuts had long been anticipated in the Mid-Continent territory when the season peak demand generally occurring about Labor Day failed to encounter the normal strength in gasoline prices, which at that time were approximately two cents per gallon (at the refinery) below the 1929 level.

An unusual feature of the present price scale is that the announcements of lower prices originated with the smaller refiners and purchasing agencies instead of the major crude oil purchasers. Lower prices had been in effect for almost two weeks before the major purchasers, led by the Stanolind Crude Oil Purchasing Co., announced a revised price schedule. The new schedules contain the lowest crude oil prices in effect since 1916.

Announcement was made October 26 that the Standard Oil Co. (New Jersey) and the Pure Oil Co. had completed an agreement whereby the Pure became part owner of the Ajax Pipe Line Co. system now under construction, while The Humble Pipe Line Co. will construct a new pipe line from Shreveport, La., to the Van field of East Texas, where the Pure is the principal producing company. The arrangement will give the Pure Oil Co. pipe line transportation for crude oil from the Mid-Continent field to all of its eastern refineries, while the Standard company will be furnished pipe line connections with its refinery at Parkersburg, W. Va. The new arrangement permits both companies to enjoy a greater flexibility in handling and transporting their crude oil.

In a decision having exceptionally broad influence upon the petroleum industry, the Supreme Court of Oklahoma sustained the right of the state corporation commission to regulate the amount of oil which may be produced from a property under the rules of state-wide proration. The powers of the corporation commission had been challenged as unconstitutional, but were upheld by the Supreme Court.

An exceptional phase of the decision, however, is found in a sentence of the court which states: "Surface owners of land have the right to drill for and reduce to possession the oil and gas beneath; but this right is to all of the owners alike, and, when numerous surface owners seek to produce from a common pool, it is within the police power of the state, in keeping with due process of law, to require the several surface owners to produce same under reasonable regulations to the end that some of said owners may not take from the common source more than their equitable share."

Should this decision of the court be sustained, it will have a most marked effect upon the development of all future oil pools within the state of Oklahoma as far as the unitization plan is concerned.

The daily potential production of the Hobbs pool in New Mexico continues to increase, and, according to last figures, was established at 819,000 barrels, an increase of 150,000 barrels in three weeks.

In California what is reported to be the largest oil well completed since 1923 was discovered by the Pacific Western Oil Co. in the Elwood field. The new well had a daily production of 15,000 barrels.

## Production and Refining Figures Furnished by the American Petroleum Institute

**Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending October 22, 1930**

(Figures in Barrels of 42 Gallons)

| DISTRICT | Per Cent Potential Capacity Reporting | Crude Runs to Stills | Per Cent Operated of Total Capacity Reporting | Gasoline Stocks | Gas and Fuel Oil Stocks |
|---|---|---|---|---|---|
| East Coast | 100.0 | 3,483,000 | 81.2 | 5,519,000 | 11,974,000 |
| Appalachian | 91.8 | 525,000 | 56.9 | 879,000 | 983,000 |
| Ind., Ill., Ky. | 99.6 | 1,779,000 | 66.7 | 5,140,000 | 4,207,000 |
| Okla., Kan., Mo. | 89.3 | 1,743,000 | 60.4 | 2,438,000 | 4,858,000 |
| Texas | 90.4 | 3,962,000 | 76.1 | 5,739,000 | 10,563,000 |
| Louisiana, Arkansas | 96.8 | 1,116,000 | 60.8 | 1,142,000 | 2,064,000 |
| Rocky Mountain | 93.6 | 356,000 | 36.4 | 1,698,000 | 1,128,000 |
| California | 99.3 | 3,559,000 | 57.5 | 13,721,000 | 104,258,000 |
| Total Wk. Oct. 22 | 95.6 | 16,523,000 | 66.2 | 36,276,000 | 140,035,000 |
| Total Wk. Oct. 15 | 95.6 | 16,597,000 | 66.5 | 37,125,000 | 139,457,000 |
| The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts. | | | | | |
| Texas Gulf Coast | 100.0 | 2,956,000 | 79.8 | 4,597,000 | 7,677,000 |
| Louisiana Gulf Cst. | 100.0 | 685,000 | 66.4 | 915,000 | 2,064,000 |

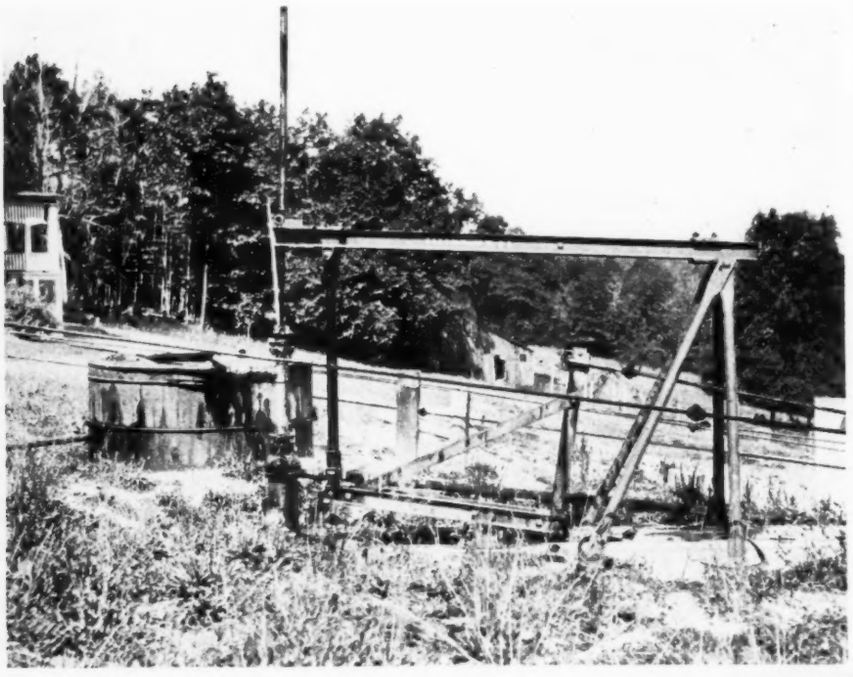
**Daily Average Production**

(Figures in Barrels)

| | Oct. 22, 1930 | Sept. 13, 1930 | Oct. 19, 1929 |
|---|---|---|---|
| Oklahoma | 545,600 | 549,100 | 708,250 |
| Kansas | 112,650 | 118,550 | 111,500 |
| Panhandle Texas | 80,900 | 85,050 | 107,650 |
| North Texas | 62,800 | 67,450 | 92,900 |
| West Central Texas | 47,650 | 51,950 | 57,300 |
| West Texas | 273,700 | 268,150 | 364,500 |
| East Central Texas | 42,000 | 42,000 | 18,450 |
| Southwest Texas | 96,900 | 95,850 | 73,000 |
| North Louisiana | 42,150 | 39,850 | 39,450 |
| Arkansas | 52,850 | 53,550 | 64,800 |
| Coastal Texas | 167,800 | 179,200 | 143,500 |
| Coastal Louisiana | 27,850 | 24,250 | 24,750 |
| Eastern (not including Mich.) | 115,500 | 113,000 | 120,250 |
| Michigan | 7,400 | 8,150 | 16,800 |
| Wyoming | 48,850 | 53,150 | 54,950 |
| Montana | 7,900 | 9,050 | 10,750 |
| Colorado | 4,100 | 4,300 | 5,450 |
| New Mexico | 46,550 | 43,450 | 6,450 |
| California | 587,600 | 613,700 | 882,500 |
| Total | 2,370,750 | 2,419,750 | 2,903,200 |

# Current Water-Flooding Problems

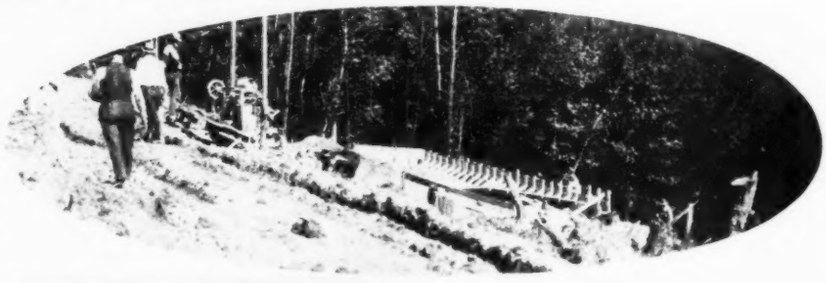
*By* K. C.



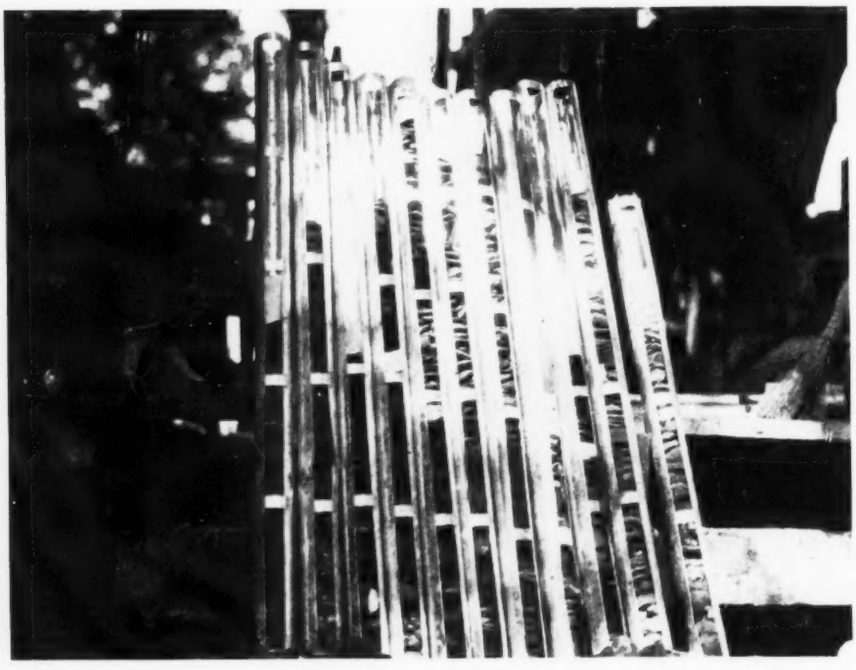
WATER-FLOODING, the process for the secondary recovery of oil that predominates in the Bradford field, Pennsylvania, is somewhat of a departure from other accepted production practices, hence calls for a new method of operating procedure in the field.

In the Bradford field today, all phases of water-flooding are the subject of assiduous study by producers. The technical aspects of the problems involved are under investigation, both in the laboratory and in the field, and a rapidly improving technique is being developed that is bound to increase the scope of application of this method of secondary recovery.

Discovery of the possibilities of the water drive was made many years ago when, as a result of well plugs become defective, the beneficial effects of a natural water drive on surrounding wells



**Above—Each well is equipped with an oil tank permitting ind.vidual gauges to be taken. At right—Pumping powers are installed at almost any angle, depending on the topography. Note the forms for the high retaining wall on the right. Below—One well in about five is cored. The samples are taken immed.ately to the laboratory for porosity and oil-content tests.**



were observed. The first type of water flood to be adopted was the "circle" flood, wherein a central well is used as a water intake well and a surrounding circle of wells as oil wells. As the water flood overtook the surrounding wells another and larger circle of wells would be drilled and the circle of wells that first went to water used as water intake wells. The disadvantages of the "circle" flood soon became apparent and led to the adoption of the "line" flood. This type of flood consisted of a central row of wells drilled as water intakes. Two rows, one on each side, were drilled as oil wells and staggered with respect to the water intake wells. As the water flood advanced to the row of oil wells, the latter in turn would be used as water intakes and succeeding rows of wells drilled in advance of the water flood. Several modifications of the "line" flood have been employed.

Great impetus was given to water-

# Encountered *in the* Bradford Field

SCLATER

flooding practice when the four-way flood or five-spot pattern was adopted, as it was a vast improvement over the earlier types of flood. The five-spot flood is more widely used today than any other. Four wells, one on each corner of a square, are drilled as water intakes and another, the oil well, in the center. Aside from the efficiency of the five-spot flood, the arrangement of oil and water wells is convenient, symmetrical and economical.

Other types of water flood include the "nine-spot", the "seven-spot" (three-way drive) and the "seven-spot" (six-way drive), but these are in limited use only.

It is gradually becoming general practice to introduce the water into the intake wells from the surface. By following this procedure, all water can be metered and the quantity controlled. The use of artificial pressure also is becoming general.

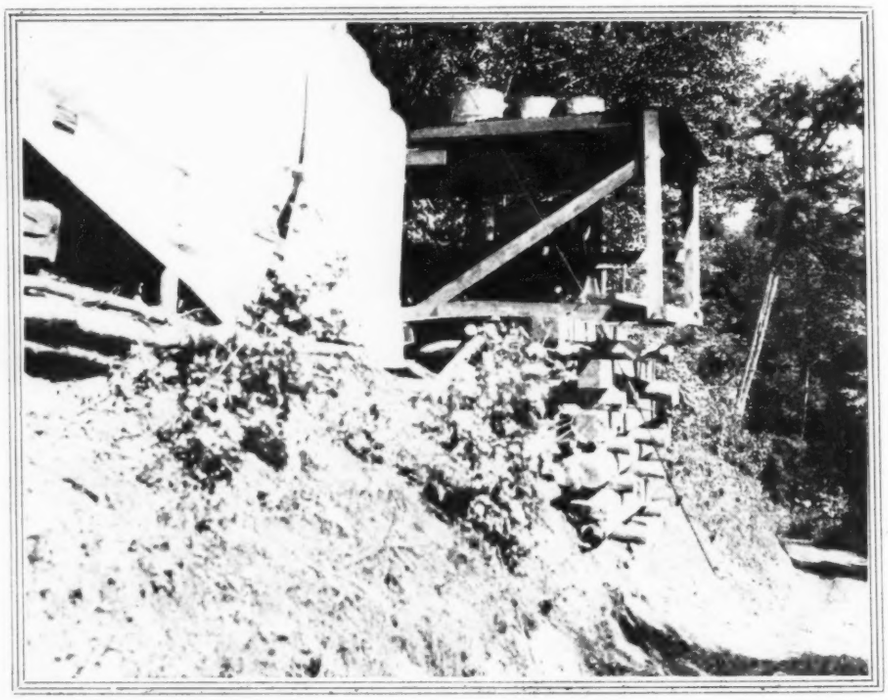
Above—Interior row of a water pump house during construction, showing the jack-shaft foundations. In the background can be seen one engine ready to be put in place. At left—A drilling rig in the Bradford field, Pa. Below—A battery of oil tanks. It is necessary to heat the oil during winter. Note that tanks are lagged and insulated.

One of the most recent developments of note in the water-flooding process is the system of delayed drilling. In another article soon to appear in this publication the system of delayed drilling will be ably discussed by Paul D. Torrey.

The main producing horizon is the Bradford sand, which lies at an average depth of about 1,700 feet in the vicinity of Bradford. Throughout the field it varies in thickness. Its probable average thickness is 40 to 45 feet.

A typical completion of a water well in a five-spot flood is here given. A nine-inch hole is drilled into the shale below the fresh water surface strata, which is found at an average depth of around 300 feet. From this point on a seven-inch hole is carried through the producing horizon and about 40 feet into the stratum below. This 40 feet serves as a sand pocket and aids in keeping the sand face free from any accumulation of silt or cavings. Cable tools are used for drilling. Practically all drilling in the Bradford field is done under contract. All wells, both water intake and oil wells are given a heavy "shot" in the sand. With the exception of 40 feet of 8¼-inch casing at the surface, no casing is left in the well. A 6¼-inch packer is run on two-inch tubing and set above the producing sand. The tubing is landed on bottom with perforated water nozzles opposite the sand. About four barrels water are dumped on top of the packer preparatory to cementing. Ten sacks cement are then pumped in on top of packer through one-inch tubing. The cement is allowed to set two weeks before pulling connections.

A 7-inch by 9-inch diameter wooden plug is placed on the tubing at the shoulder where the hole is reduced below the surface water horizon. A split tapered wooden plug is inserted in the 8¼-inch casing at the surface. Each water well is equipped at the surface with a check valve, a water meter, a strainer and a valve for regulating the flow of water into the well.



**A drilling rig on the hill side, Bradford, Pa. Note the underpinning at the power end of the drilling rig necessitated by the rough topography.**

Oil wells usually are cased only to the top of the producing sand with 6¼-inch casing, and have open hole from there on down. As in the water intake wells, a 40-foot sand pocket is drilled below the producing horizon. Tubing is landed on bottom and at the lower end consists of a 40-foot anchor, then about five feet of perforated tubing above which the pump is placed. Wells are pumped from central jack plants through rod lines and pumping jacks.

One of the important problems in many parts of the field is the quantity and quality of the water supply, especially the latter. Among the most deleterious ingredients encountered in the water supply are iron salts. These on oxidation form gelatinous precipitates, which clog the pores of the sand. Water also has to be treated for fine silt in mechanical suspension. To treat the water one company is using on certain leases pressure filters of the vertical type. Lump alum is used as a coagulant to hasten precipitation of silt or other solids in suspension. Turbidity tests and analyses are made on the water at regular intervals. Water is obtained from the fresh water zone, the depth of which averages about 300 feet. In certain localities and at certain seasons of the year the water supply from this source is inadequate. Water is now brought in from the north edges of the field through a 24-inch water line which has recently been laid by one of the operating companies to insure an ample supply of water for its operations. Water is also sold to other operators at a nominal cost. Operators believe that it is good economy to pay close attention to the quality of the water used in flooding operation, as it prevents the clogging of underground channels and thus tends to keep pumping pressures at a minimum while pumping the required quantity of water.

Water pressures employed vary from a few pounds to 1,200 pounds or more per square inch. The pressure required is influenced by many factors, nor is it by any means constant throughout the life of the water flood. Tests are made on core samples for porosity, saturation and grain size—the latter for information regarding the permeability which is one of the chief factors governing the pressure necessary. Most operators now make it routine practice to core every well, or every few wells drilled, depending on the amount of information desired. Information obtained from tests of core samples, especially the variation in thickness, saturation, porosity, permeability and presence of shale intercalations is most fundamental in character and is used as a basis in determining the proper method of water-flooding procedure to pursue. Many valuable papers have already been written discussing coring and the value of core sample analysis in the Bradford field. One of the incongruous sights of the Bradford field is the co-existence of the oldest relics and the most modern of equipment on a lease. Water-pumping plants equipped with high-pressure pumps and auxiliary equipment of the very latest design and modern central jack pumping plants, housed in substantial steel structures, models of present-day efficiency, can be seen alongside equipment which harks back to the seventies, but is by no means belittled by comparison.

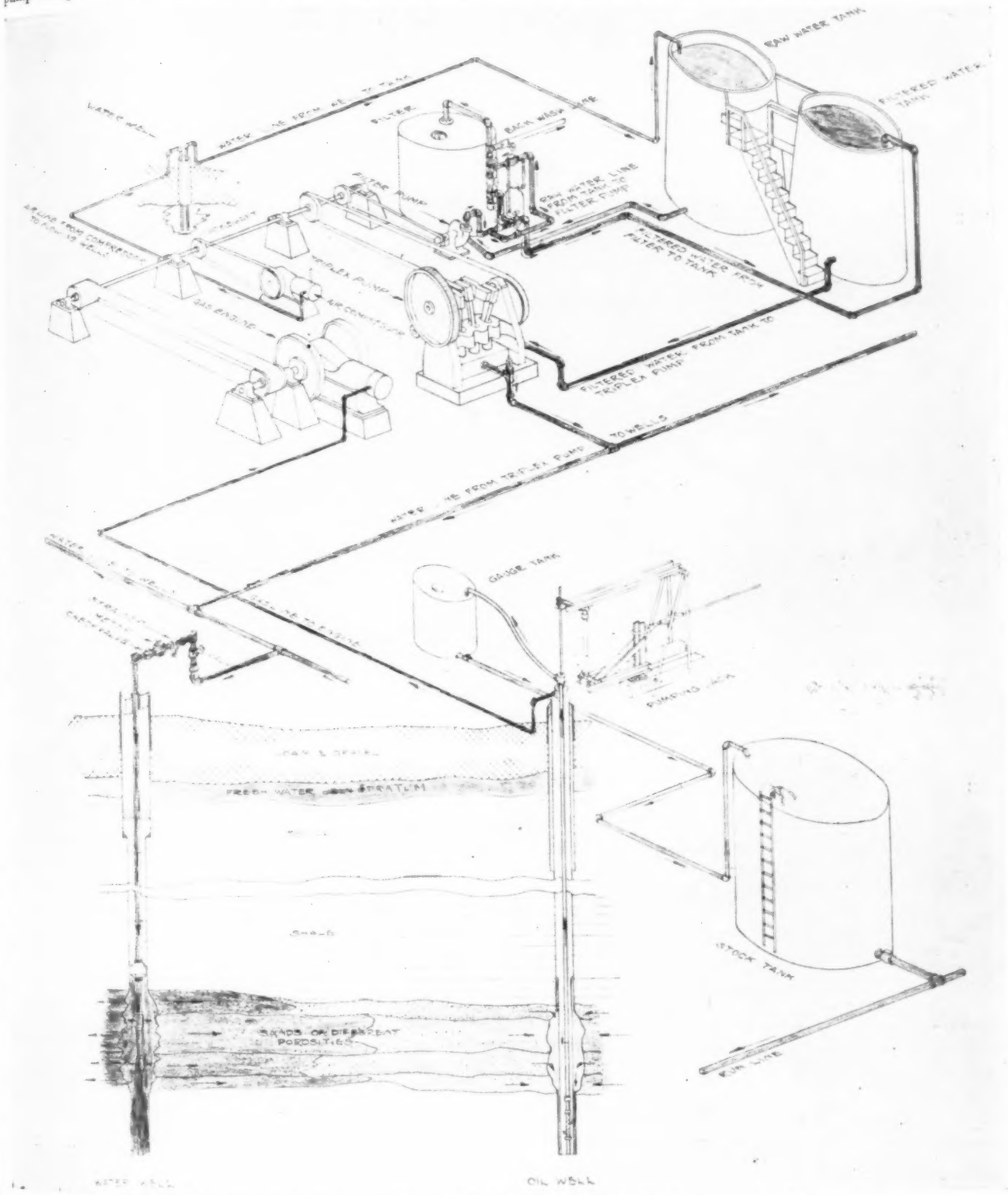
The number and type of pump units used in the water-flood pumping plants are by no means standard. When plants are running well up to capacity the service is somewhat severe. Flexibility in capacity and high efficiency is demanded. In one of several pumping plants visited, for example, the station equipment consisted of several pump units of the slow speed (36 r. p. m.) vertical plunger type, with a plunger stroke of eight inches, and belt driven by gas engines. These units were equipped to operate at 120 gallons per minute at 485 pounds pressure or 60 gallons per minute at 900 pounds pressure by using a four-inch or a

five and one-half-inch plunger, respectively. The change from one size cylinder and plunger to another size can be quickly made if necessary. Most of these plants are practically automatic in operation, requiring only a minimum of the pumper's time. They are provided with automatic electrically operated signals. These are connected to the water discharge and ring a bell in the pump house or, if at night, in the plant operator's house, in case of a sudden increase in pressure. Auxiliary equipment consists of a small air compressor for furnishing air for lifting the water from the shallow wells furnishing the water supply. Where pressure filters are used for treating the water, a small centrifugal pump comprises the remainder of the auxiliary equipment. Where it is necessary to treat the water the pumping plant is usually equipped with two tanks, one for raw water and one for filtered or treated water.

A flow sheet of a complete cycle in the water-flooding process is well illustrated in a diagrammatic sketch accompanying this article.

Water meters and all water intake well connections must be protected against freezing in winter.

Several companies use boxes about four feet square by three feet in height filled to within a few inches of the top with insulating material. Spent fuller's earth (refinery refuse) makes an ideal insulating material and is widely used for this purpose in the Bradford field.




**Diagrammatic sketch outlining the essential operations involved in the water flooding process for oil recovery.**

# *Some Problems* CONSTRUCTION, OPERATION

*By* A. H. B. GORE, *Manager Pipe Line Dept., and*

OIL manifolds may be considered as of three classes: First, the simple kind where two or more tanks containing the same product are connected by a suction line to a pump discharging into a single discharge line. In this case the only separation necessary is accomplished by the gate valves on the tanks; the gate valve on the tank from which the oil is to flow to the pump being open, the rest of the tank gate valves being closed.

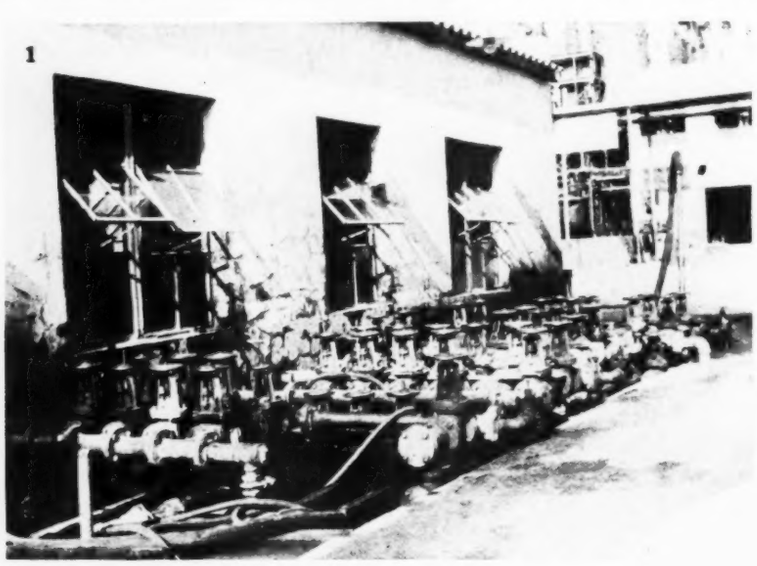
The second class, where two or more different products are alternated through the same discharge. In this case only the suction to the pump has to be manifolded to make this separation possible.

The third class, where two or more different products are to be shipped to different destinations. This case calls for manifolding both suction and discharge lines, and is more or less complicated, depending on the number of different products to be handled and the space available.

Main oil trunk lines require for the most part the simple form of manifold. In the Marine Terminals and Refineries complicated manifolds are often necessary.

In the construction of oil manifolds, simplicity is one of the main essentials. The oil should have as free a flow as possible. All gates should have rising stems, making it easy to see which gates are open and which are closed. The advent of the welding torch has done away with many fittings and considerable labor, and permits of a much neater-appearing manifold than was the case when fittings were used throughout.

All gate valves on a manifold should be numbered. A chart of sufficient size to show the gate valves, lines to and from the manifold, should be kept close by. For any necessary movement of oil through the manifold the proper valves to open or close may be



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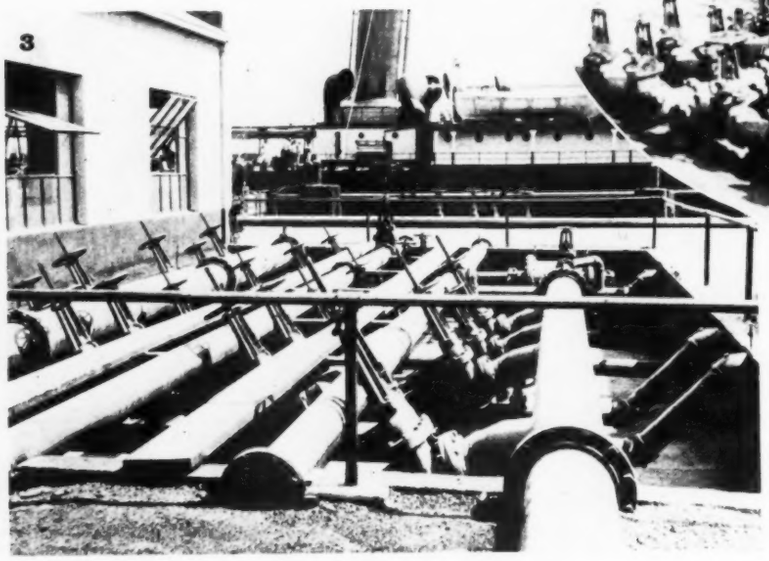


3

Top—Light refined-oil manifold. Lines are all 4-inch. At left—Gasoline and kerosene manifold for shipload-ing at harbor terminal; tanker in background being loaded. Directly above—Transfer manifold (also shown in background of illustration No. 5).

# *Affecting* and CARE *of* OIL MANIFOLDS

N. J. MARTIN, *Pipe Line Engineer, Richfield Oil Co.*

selected by number and the order so given in writing to the operator. This is very important; any mistake in the manipulation of the valves may have very serious consequences.

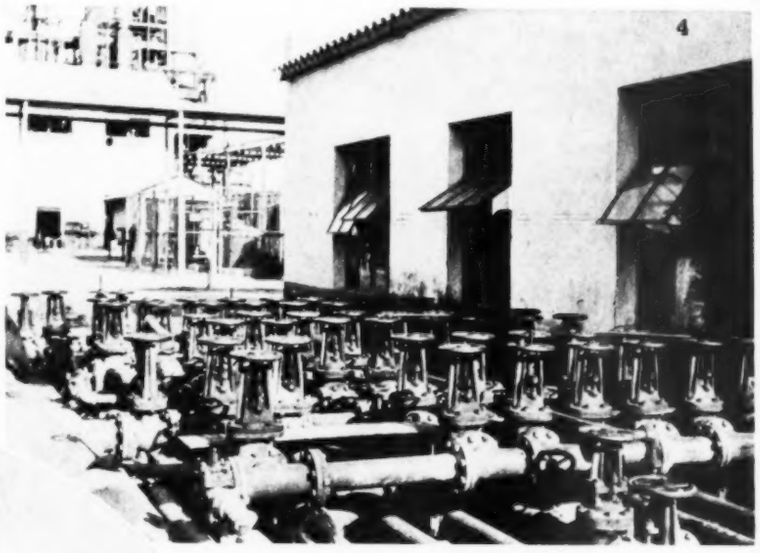
It is customary in the case of complicated manifolds to build a concrete pit to hold them. Any leaks are then readily discovered and the oil is kept from spreading. Fire-fighting equipment should always be at hand. Where hot oil is handled in a manifold, particular care must be taken to allow for expansion and contraction.

An example of the first type of manifold mentioned is illustrated in Figure 1. In this particular instance eight 5,000-barrel and two 2,500-barrel crude oil storage tanks are connected by a simple suction manifold made of 6-inch screwed pipe, screwed tees, companion flanges and screwed gate valves. This system is typical of tank manifolds which, being used for suction only, is for low pressures and is therefore made up of standard 125-pound fittings.

In this case the tank valves are of the non-rising stem style. After the tanks were erected and valves were placed, the nipples and tees were screwed in place as far as the main header; pipes were then screwed into the tees, the final connections between tanks being welded to form a straight line header. In this way a minimum of strain is put onto the tank connections and the fittings.

Flanged connections in the risers are necessary to allow removal or repairs to tank valves or adjacent fittings; also in case one or more of the tanks are removed. An additional set of companion flanges is sometimes placed between the valve and first tee, giving greater flexibility in case it becomes necessary to disconnect.

It will be noted that tees are used in all cases where ells



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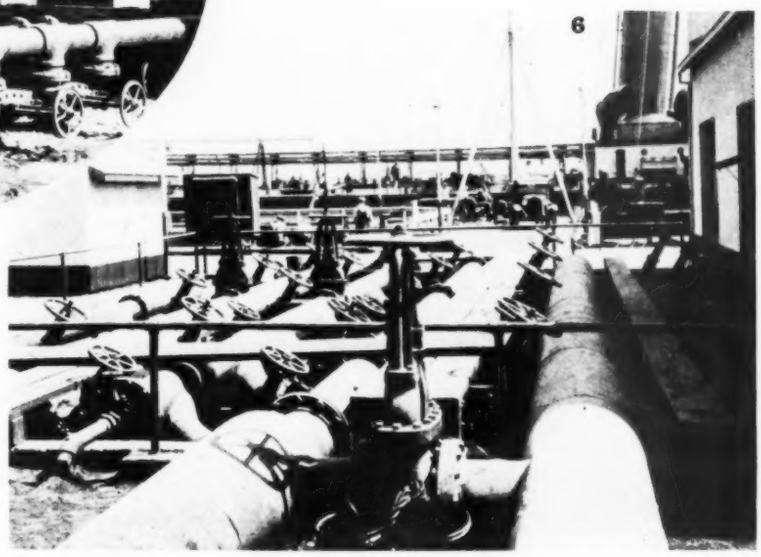


6

Top—Gasoline manifold; all lines are 4-inch. At right—Fuel and crude oil manifold for shiploading and unloading at harbor terminal. Directly above—Shipping manifold; transfer manifold in the background is shown close up in illustration No. 2.

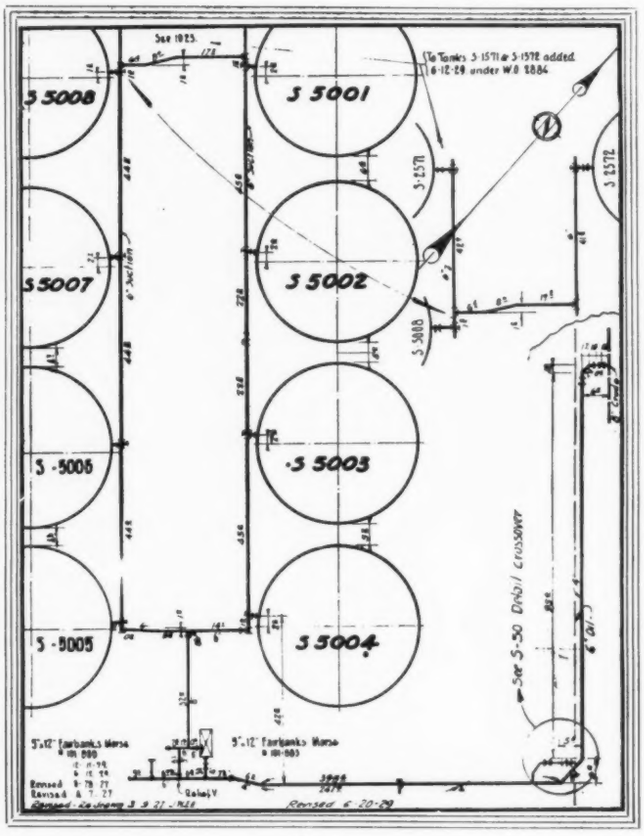



Fig. 1

would apparently serve as well. Experience has shown that it is a wise provision, as extensions may be made as required. Where tees are above ground, cast pipe plugs are used; but where fittings are buried, bull plugs are used, as they can more easily be disconnected if rusted than cast plugs.

The nipples used to make connections should be at least as long as the diameter of the pipe to reduce the chance of injuring threaded ends when salvaging. Cast iron flanges are used in connecting tanks of small capacity (1,000 barrels or less) and forged steel flanges in larger tanks, as the flanges are the weakest points and liable to break in case of fire, or uneven settling when tanks are filled.

The accompanying illustrations (numbers 5 and 6) show a manifold which was built in the shop and assembled at a Marine Terminal for quick loading of fuel oil. At the time this manifold was built, radius bends had not come into general use. The manifolds shown could have been built into a smaller space had radius bends been used. All changes in direction of flow have been taken care of by long, sweeping curves to reduce friction. This is important, particularly in suction lines and in handling fuel oil of high viscosity.

Illustration number 6 shows the 22-inch suction line directly in the foreground running to the background. Pump house is on the right. Illustration number 7 shows this manifold from a point opposite to that shown in illustration number 6, and pump house is shown on the left side. Illustration number 3 is that of a gasoline manifold at the opposite side of the pump house.

Illustrations numbers 2 and 5 are of a manifold designed to (1) ship fuel oil from any one of a large number of storage tanks to any one or more outside points, or (2) transfer oil from tank to tank at a refinery. Isometric Fig. 2 is of the system as originally installed with four pumps. The system later had two more pumps and other lines added; the illustrations numbers 2 and 5 are of a still more recent date, after additional connecting lines were added. With this system, which is quite elastic, it is possible to effect movements of several commodities at the same time. There are at present eight suction lines and six discharge lines interconnected. The discharge lines are 4-inch, 6-inch and 12-inch, and the suction lines 6-inch, 8-inch, 10-inch, 12-inch and 18-inch, and there is hardly a movement of oil in the refinery tank farm which cannot be effected with this manifold.

Standard fittings (125-pound) are used on the suction lines and steel gates with extra heavy fittings are used on the discharge lines. To insure against loss of oil should a tank valve break, these valves are of steel on large tanks in refineries and marine terminals.

At each valve the tee immediately above it is plainly labeled in large painted letters showing the source and size of the underground line to which it is connected.

Illustrations numbers 1 and 4 give a general idea of two manifolds designed for handling light oils such as kerosene and gasoline, and used principally for transferring at a refinery.

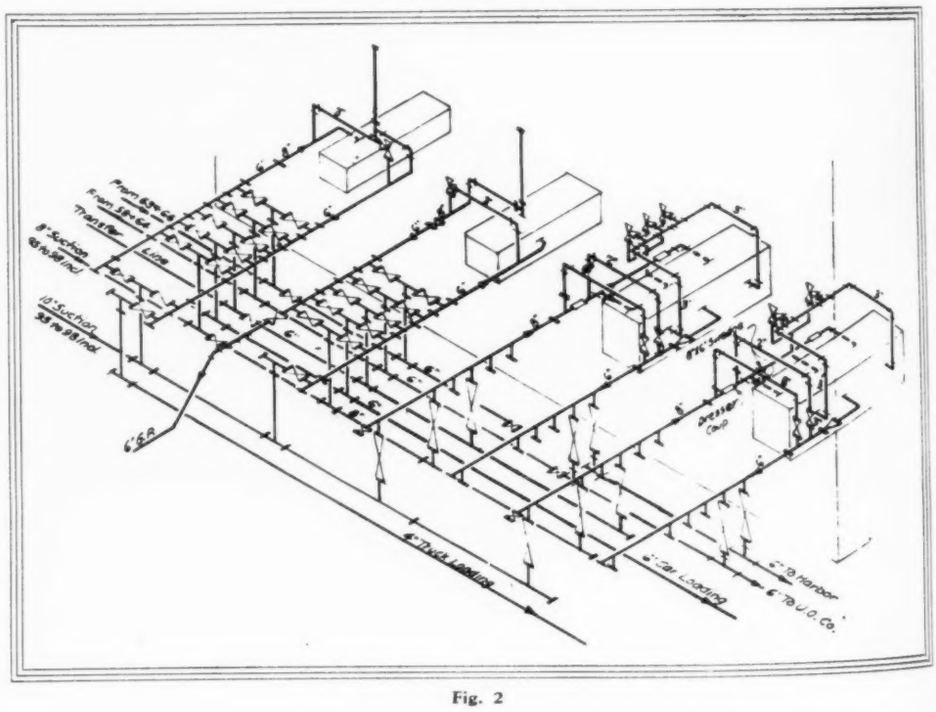
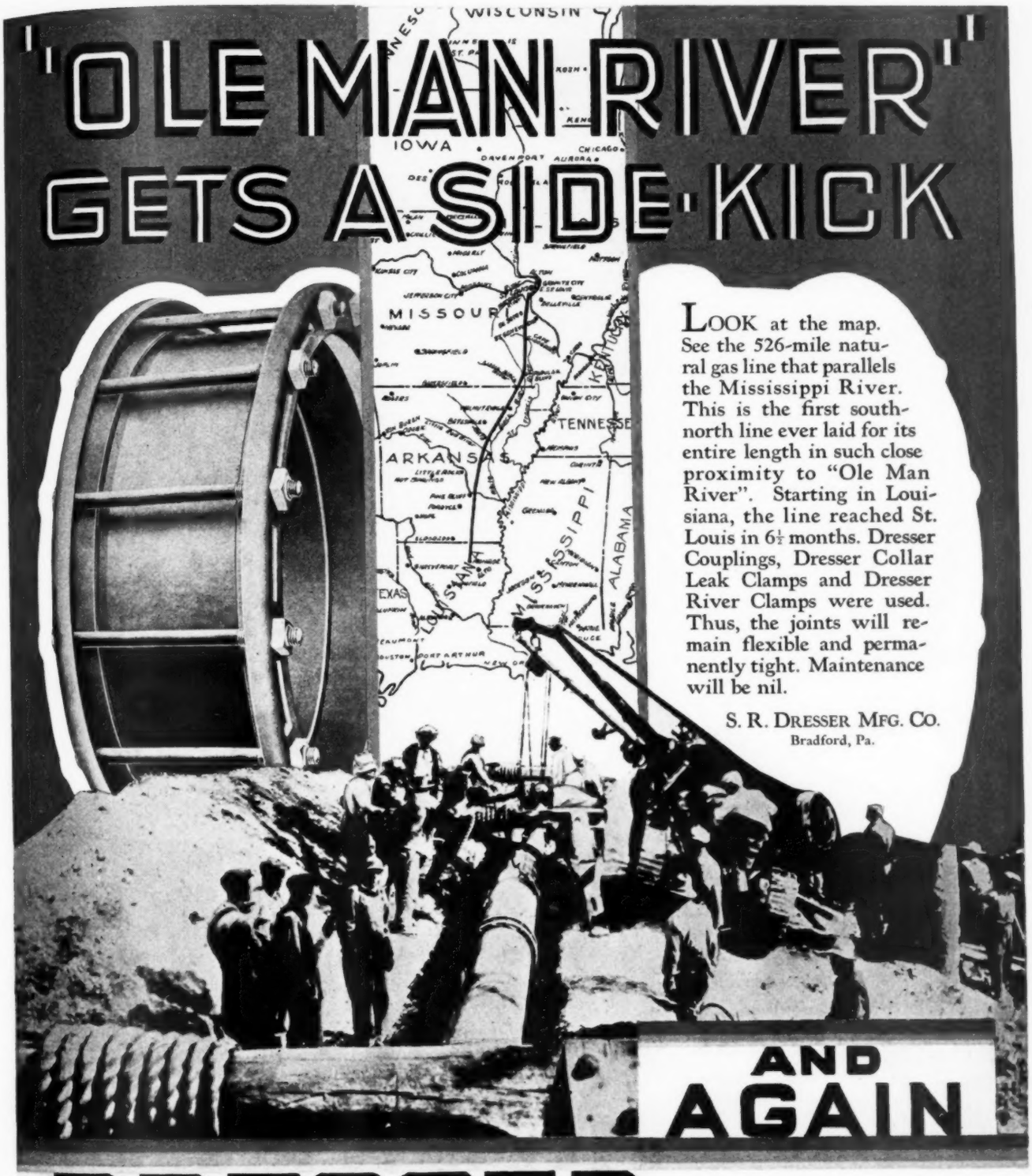



Fig. 2

# "OLE MAN RIVER" GETS A SIDE-KICK




LOOK at the map. See the 526-mile natural gas line that parallels the Mississippi River. This is the first south-north line ever laid for its entire length in such close proximity to "Ole Man River". Starting in Louisiana, the line reached St. Louis in 6½ months. Dresser Couplings, Dresser Collar Leak Clamps and Dresser River Clamps were used. Thus, the joints will remain flexible and permanently tight. Maintenance will be nil.

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## *Factors Encountered In » » »*

# Treating Water For Gasoline Plants

*By* A. J. SCHLOSSER, *General Superintendent Natural Gasoline Division, Barnsdall Oil Co.*

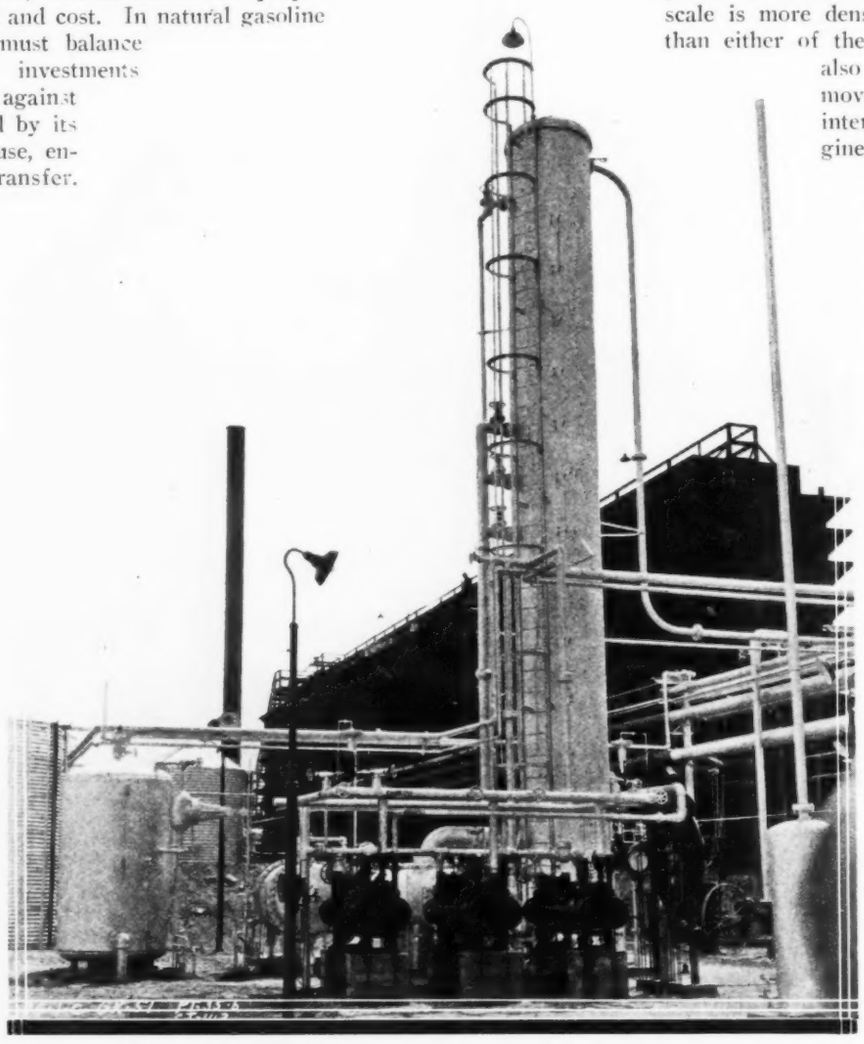
THE problem confronting the division engineer, responsible for economical operation of his plant, is whether the application of water-treating processes will result in operating economies in excess of the investment and operating costs required for the installation. A careful survey of the individual plant, particularly the operating conditions, will determine the proper balance between value and cost. In natural gasoline plants the engineer must balance the water treatment investments and operating costs against the economies effected by its application to boiler use, engine-cooling and heat transfer.

The principal economic loss chargeable to hard water in the loss of efficiency to either one of the above-mentioned industrial applications, is scale formation.

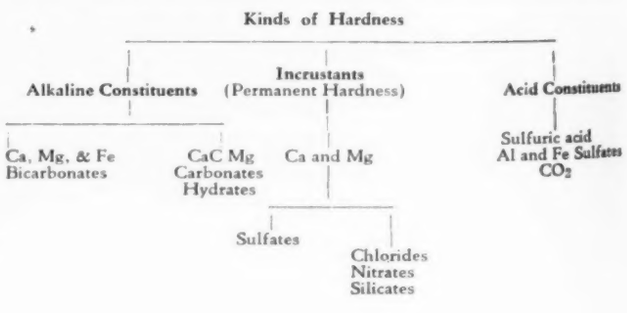
Hardness is due to the presence of the bicarbonates, carbonates, sulfates, chlorides and nitrates of calcium and magnesium. When hard water is boiled, it loses its bicarbonates, or temporary hardness, leaving the mineral acid, or permanent, hardness as well as some hardness due to the carbonates which cannot be so removed. Total hardness is the sum of temporary and permanent hardness which can be determined accurately enough for practical purposes by the common soap test. Types of hardness may be found under the diagram at the bottom of this page.

The character of the scale, it will be noted from this table, is quite important as well as the thickness in determining the loss in fuel efficiency. Scale from two boilers using the same feedwater may vary greatly in composition, due to the frequency of blow down and the rate at which they are operated. It is, therefore, difficult to predict just what scale will be formed from any analysis, unless the analysis clearly indicates that the feedwater is of a definite type. However, from the above table it can be well understood as to why the fuel cost of oil field boilers is so high, because it is not uncommon to find ⅛-inch to ⅜-inch scale in such boilers. It has been estimated by authorities that ⅜-inch of scale will show 48 per cent loss of heat from the fuel used.

The three types of scale formed are carbonate, sulfate and silicate. The carbonate scale is more porous than the sulfate scale. Silicate scale is more dense and also harder than either of the other types. It is also more difficult to remove. All operators of internal combustion engines are aware that the scale resulting from the use of hard water is detrimental to efficient operation. The disadvantages of hard water are brought most forcibly to their attention by breakage of heads and jackets, necessitating shutdown and expensive replacements. Some operators also know that the formation of scale results in poor heat transfer and that the heat formed by combustion, which should be absorbed by the cooling water, remains in the metal of the head and jacket, and requires an increased amount of lubricating oil to properly lubricate the pistons, rings, pins and cylinder



Stabilizing unit in a California natural gasoline plant.



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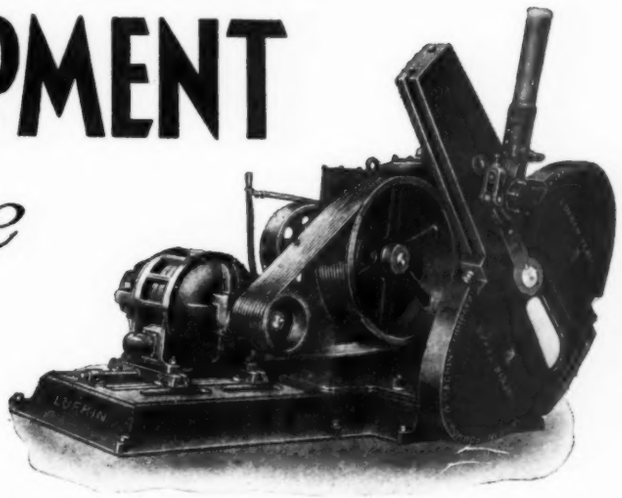

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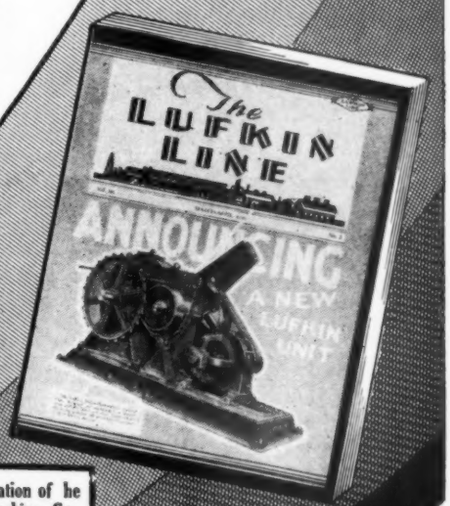


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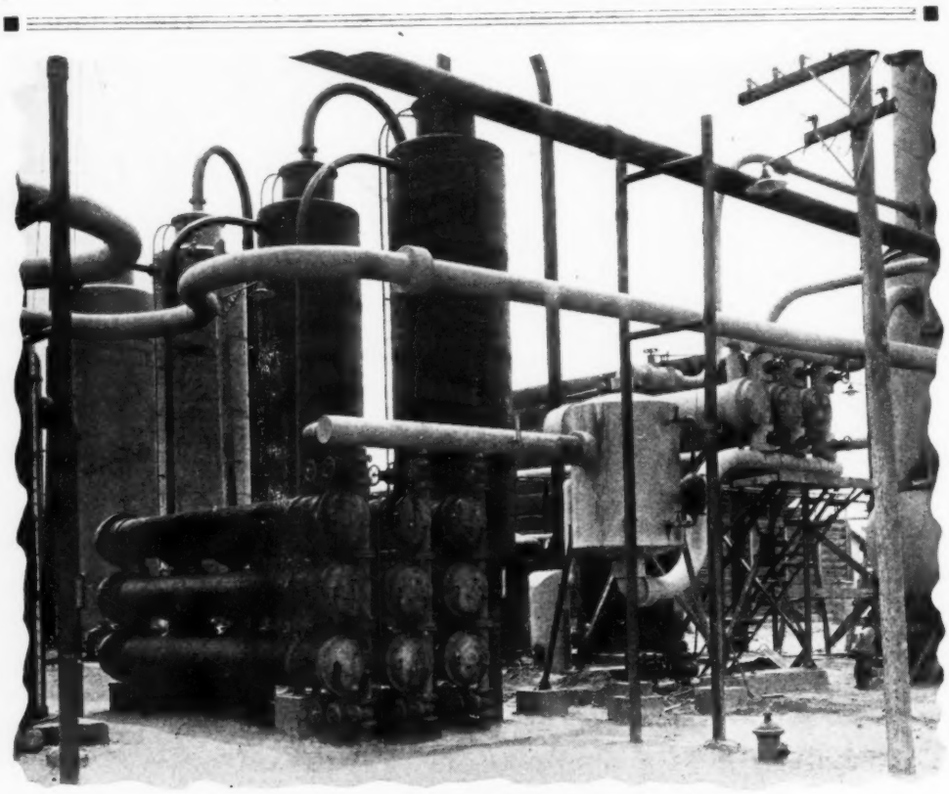
LOSS IN FUEL EFFICIENCY DUE TO BOILER SCALE

| Character of Scale | Thickness | Composition | Loss of Efficiency in Per Cent |
|---|---|---|---|
| Hard | 1/50" | Mostly Carbonate | 9.4 |
| Soft | 1/23" | Mostly Carbonate | 7.2 |
| Hard | 1/32" | Mostly Carbonate | 8.5 |
| Soft | 1/25" | Mostly Carbonate | 8.0 |
| Hard | 1/25" | Mostly Sulfate | 9.3 |
| Hard | 1/20" | Mostly Sulfate | 11.1 |
| Soft | 1/16" | Mostly Sulfate | 10.8 |
| Soft | 1/16" | Mostly Carbonate | 11.0 |
| Soft | 1/16" | Mostly Carbonate | 12.4 |
| Hard | 1/16" | Mostly Carbonate | 12.6 |
| Soft | 1/11" | Mostly Carbonate | 15.0 |
| Hard | 1/8" | Mostly Sulfate | 15.9 |

wall. The valve seats and valves cannot be cooled efficiently and an insulating layer of scale retards heat transfer from these vital parts. As a result, in plants where the engine jacket water is not softened we find the valves badly burned and crystallized to the point where the valve is snapped off or badly pitted from the mill-like iron scale caused from the intense heat.

In reference to the consumption of lubricating oils, soft water used for cooling heads and engine jackets saves about two-thirds of the amount of lubricating oil required for engines using hard water for cooling. It has been found on one investigation of typical engines with reference to H. P. operations, that those using soft water in cooling required only .23 gallon of oil per day per engine, while those using hard water for cooling required .86 gallon of oil per day per engine. Assuming a 340-day operating year, it shows only 78 gallons of oil per year per engine for lubricating oil when using soft water, as compared with 292 gallons of oil per engine per year when using hard water. The reduction of operating expense in the same investigation showed a saving of $0.059 per hour of operation; or, putting this saving on a yearly basis, as assumed above, it showed a reduction in operating cost of $516.84 per year per engine for use of soft water.



Heat exchangers in a Texas Panhandle gasoline plant.

It is readily evident from the above figures that a definite reduction of lubricating oil and machinery repair costs more than balances the depreciation of water-treating equipment and the treating operating charges.

The theory of colloids helps to explain many phenomena of water purification. The old idea that colloids (e. g., glue) were those substances which would not dialize through parchment, and crystalloids (e. g., salt) were those which would, has been abandoned. Colloids are simply matter in a finely divided or highly dispersed condition, yet not so finely divided as to form true molecular solutions. In order to be dispersed in colloidal form, a substance must be so finely divided that it will remain in suspension indefinitely.

The force which holds these very fine particles in suspension is a property of their surfaces. Particles in the colloidal state are smaller than 0.0001 mm. in diameter and in some cases no larger than 0.000,006 mm. The enormous increase in surface area due to division of matter greatly augments the capacity of the substance for absorption. This has an important bearing upon the power of aluminum and other hydrates used as water coagulants which, when precipitated in water, pass gradually through the colloidal into the true suspended state, and in doing so offer, because of their small size, a corresponding vast surface for the attraction of suspended matter such as clay, color and bacteria in the water.

Where water is the external phase of colloids, and where the colloids are suspended electrically, the particles will migrate or move when an electric current is present, to the positive or negative poles, depending upon the preferential absorption of negative or positive electrical charges by the particles. Colloidal clay has a negative, aluminum hydrate, a positive charge. The purpose of coagulation with reference to cold water treatment is to gather into groups or flacs particles which in a dispersed condition could not be removed by subsidence or filtration. The vast surface presented by the jelly-like compound which is formed by the addition of a coagulant to an alkaline water causes the absorption of color, organic matter and other substances, which exist in true or colloidal form.

Sulfate of alumina, frequently though erroneously called alum, is the most commonly used coagulant. It is basic—that is, it contains more hydrate that will combine with sulfuric acid to form a neutral salt. Best sulfate of alumina contains 17.5 to 18.5 per cent $Al_2O_3$. The theoretical maximum alkalinity computed as $CaCO_3$ that can react with 1 g. p. g. (gram per gallon) of ordinary 17.5 sulfate is 8.2 p. p. m., or 1 p. p. m. of alkalinity to 2.08 p. p. m. of sulfate. In practice, the reduction of alkalinity may be as low as 60 per cent of the theoretical or 0.5 p. p. m. per 1 g. p. g. of sulfate. $CO_2$ set free by the reaction with the alkali in water averages 3.4 p. p. m. per 1 g. p. g. (1 g. p. g. = 17.12 p. p. m.) As a result of this liberation of $CO_2$, an excess of lime must be added.

Ferric sulfate in conjunction with lime is a very good

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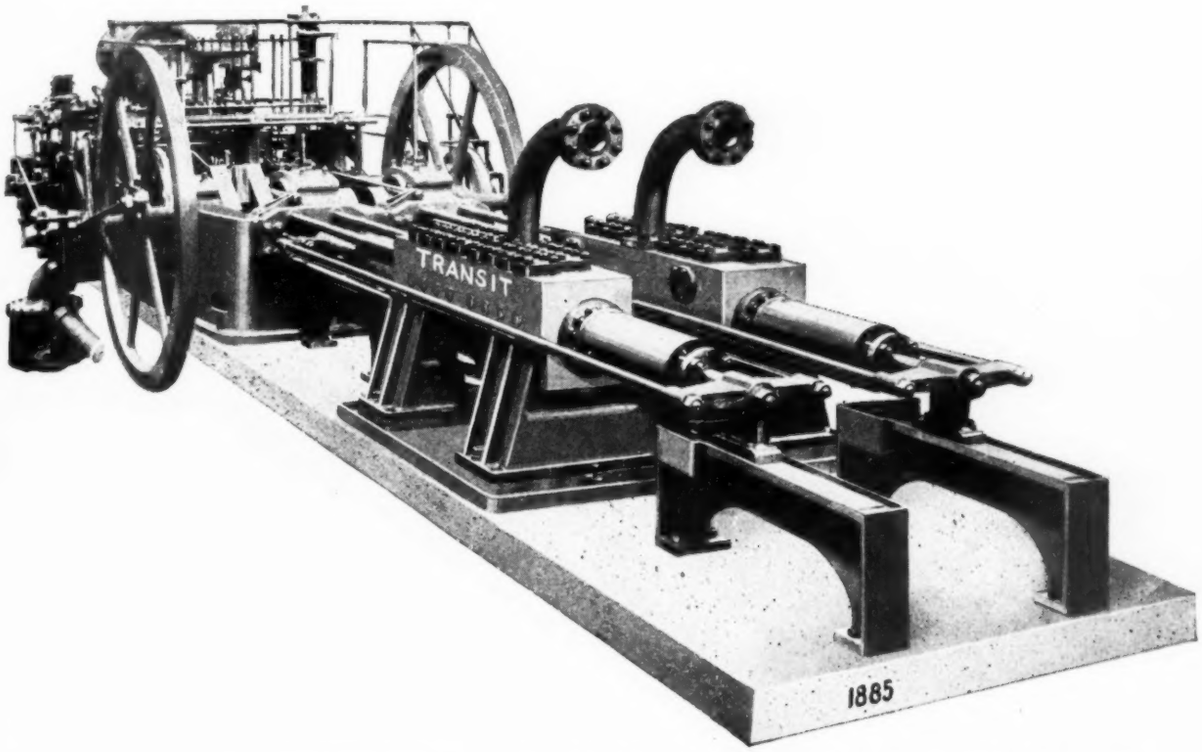


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coagulant for turbid, alkaline waters. Its formula is $Fe\,SO_4\ .7\,H_2O$. The best form, known as "sugar of iron," is partially dehydrated and contains over 100 per cent of sulfate when calculated as $Fe\,SO_4\ .7\,H_2O$. The reaction is complicated, but may be given as follows:

$Fe\,SO_4 + Ca\,CO_3\,H_2\,CO_3 = Fe\,CO_3\,H_2\,CO_3 + Ca\,SO_4$

iron sulfate + calcium bicarbonate, ferrous bicarbonate + calcium sulfate. Lime is then added to remove the $CO_2$ and complete the reaction:

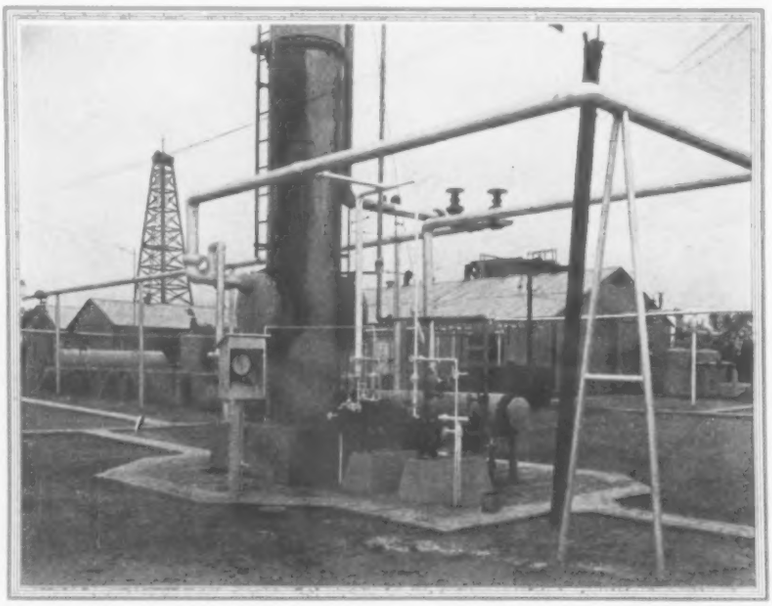
$Fe\,CO_3\,H_2\,CO_3\,Ca\,(OH)_2 = Fe\,(OH)_2\,Ca\,CO_3\,H_2\,CO_3$

The $Fe\,(OH)_2$ formed is a gelatinous precipitate similar in action to that produced by sulfate of alumina.

Lime is used for water softening; for an alkali with ferrous sulfate and sulfate of alumina. For water softening, the lime should not contain less than 90 per cent soluble CaO. This chemical is the cheapest type for water softening.

Soda ash, anhydrous sodium carbonate ($Na_2CO_3$), containing not less than 58 per cent $Na_2O$ or 98 per cent of $Na_2\,CO_3$, to furnish alkali to waters which are deficient therein, and to soften water having "permanent" hardness. Theoretically, one part of sulfate of alumina requires 0.5 part of sodium carbonate to precipitate it.

The amount of coagulant to be used is best determined by experience. Enough coagulant should be added to form a heavy gelatinous fog or precipitate in the water. For the lime and soda ash calculation, the water must be titrated with N/50 sulfuric acid, using phenolpthalein and methyl orange as indicators. By using 100 cc. sample of water for the titration, each cc. of acid used multiplied by 10 gives the p. p. m. to be used in the following calculation, in which P = p. p. m. as indicated by the phenolpthalein and M = p. p. m. as indicated by the methyl orange.



Recorder-controller actuating reflux pumps in a Breckenridge (Texas) gasoline plant.

Experience has shown that good operating results are obtained when:

1. P—M lies between 10 and 20 p. p. m. and
2. 2M—H lies between 10 and 20 p. p. m.

When P—M is less than 10 p. p. m., increase the lime treatment, and greater than 20 p. p. m., decrease the lime. Likewise, increase the soda ash when 2M—H is less than 10 p. p. m., or decrease it when it is greater than 20 p. p. m. The amount of chemicals to be added or decreased may be calculated, noting the number of parts per million below or above these imperically-determined values.

Suppose the titration showed that P—M = 30 p. p. m., then the excess added is 30 — 20 = 10 p. p. m. of lime as $Ca\,CO_3$ to 1,000,000 parts of water.

We use a straight proportion from the following chemical formula:

$$\frac{Ca\,CO_3}{Ca\,(OH)_2} = \frac{Ca\,CO_3}{Ca\,(OH)_2}$$

This means that the amount of total calcium carbonate hardness is to the amount of lime treatment, or the amount of carbonate hardness (either plus or minus) it will take to react with the lime treatment $Ca(OH)_2$.

Using the molecular weights of the calcium carbonate and $Ca\,(OH)_2$ (lime) direct proportions with the parts per million and (X) the lime treatment, we get the following:

$$\frac{100}{74} = \frac{10}{X} \text{ where}$$

100 = mol. weight of $Ca\,CO_3$
74 = mol. weight of $Ca\,(OH)_2$
10 = Calculated p. p. m. excess
X = lbs. of p. p. m. to be deducted.

$$\text{Therefore, } X = \frac{740}{100} = 7.4 \text{ p. p. m. of } Ca\,(OH)_2 \text{ of } 100\% \text{ pure.}$$

Now, 1 p. p. m. = .84# per 100,000 gal.
Or 1 p. p. m. = .084# per 10,000 gal.

Therefore, 7.4 p. p. m. excess = 7.4 × .084 = .614 lbs. of lime to be deducted from the treatment.

I might add that if the (P—M) showed a (—10), the same calculation would be used and lime treatment would be increased .614 lbs. per 10,000 gallons.

In a preceding paragraph I explained how we could convert the grams per gallon of total hardness from our soap test into p. p. m.

Now, let us assume that 2 P—H = 10 p. p. m. This, we can assume, shows a lack of soda ash and 20—10 = 10 p. p. m. of soda ash to be added. Using the same method of proportion as in the lime calculation and assuming we want to take out magnesium sulfate, we work from the following formula:

Mg $SO_4$ as Sulfate 120 : $Na_2\,CO_3$ Soda Ash 106 = $Na_2\,SO_4$ Sod. Sulf. 10 : Mg $CO_3$ Mag. Carb. x or

$$\frac{120}{106} \text{ as } \frac{10}{X} \text{ where}$$

120 = Mol. weight of magnesium sulfate.
106 = Mol. weight of magnesium sulfate.
10 = p. p. m. calculated is soda ash to be needed.
X = p. p. m. to be added.

Therefore, 120 X = 1060

$$X = \frac{1060}{120} = 8.8 \text{ p. p. m. of } Na_2CO_3 \text{ of } 100\% \text{ pure.}$$

1 p. p. m. = .84 lbs. per 100,000 gal.
or 1 p. p. m. = .084 lbs. per 10,000 gal.

Therefore, 8.8 p. p. m. = 8.8 × .84 = .739 lbs. of soda ash to be added per 10,000 gallons of treatment.

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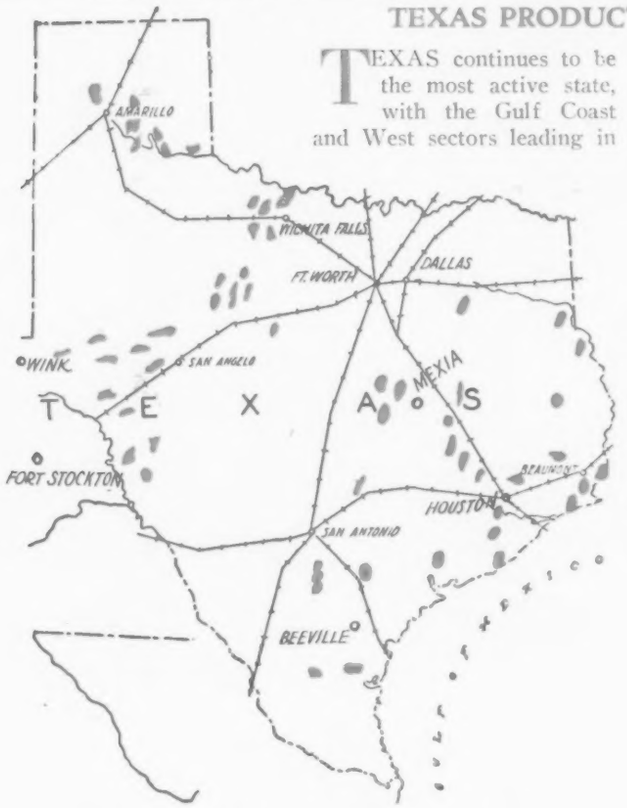
# Latest Activities *in the* Oil Fields*

## TEXAS PRODUCTION, 1929—299,054,250 Barrels



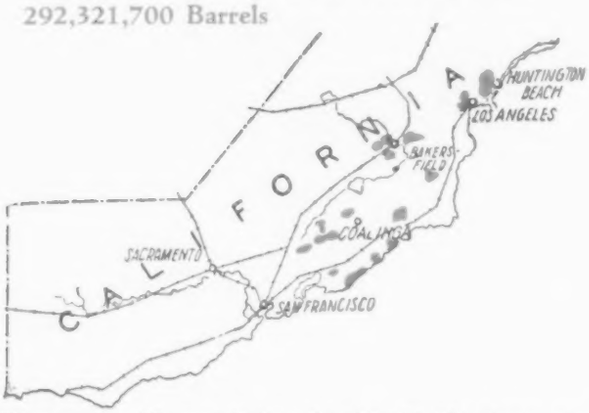

TEXAS continues to be the most active state, with the Gulf Coast and West sectors leading in activity. The state had 449 completions during September, and had 226 rigs and 825 drilling wells. Most of this activity is pretty well scattered, with no unusual concentration in any one pool.

A review of the most active fields in the state is as follows:

| Field | Completions | Type of Tools | Rigs | Drilling Wells |
|---|---|---|---|---|
| Refugio | 12 | Rotary | 2 | 25 |
| Barber Hill | 6 | Rotary | 0 | 30 |
| Darst Creek | 11 | Rotary | 11 | 20 |
| Pettus Area | 13 | Rotary | 10 | 16 |

The Refugio field with its many producing horizons and heavy pressures in the deeper producing horizons is the most troublesome to drill. Several wild wells have developed in the pool because of the pressures.

## CALIFORNIA PRODUCTION, 1929
## 292,321,700 Barrels



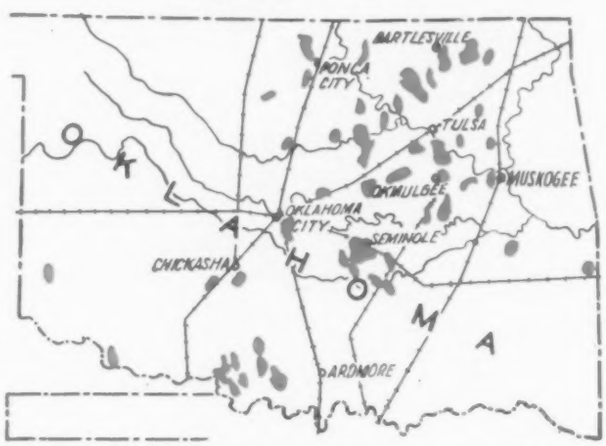

There were 72 completions in this Pacific Coast state last month. Playa Del Rey led with 20, while Long Beach had 14 and Kettleman Hills 1.

Playa Del Rey is also the most active spot, having 150 drilling wells and 16 rigs. This field is now probably at its most active period.

Throughout California the drilling operations are carried on with heavy type rotary machines.

Several tests are expected to get under way in the Kettleman Hills field unless the proposed unit operation of properties is carried throughout. This field offers one of the greatest drilling problems because of high pressure, while its proven producing area is believed to be the greatest light-oil producing one in the world.

## OKLAHOMA PRODUCTION, 1929
## 251,269,400 Barrels




There were 298 completions in Oklahoma, which state has 90 rigs and 632 drilling wells. General activity throughout the state is expected to show a decline in the coming months, due mostly to the large drop in drilling wells in the Oklahoma City field. With Oklahoma City passing from the active drilling field, and turning more attention future production methods, there is no real active or prospective competitive drilling field in the state.

Oklahoma City still continues to be the most active field. Following is a summary of operations in the active spots:

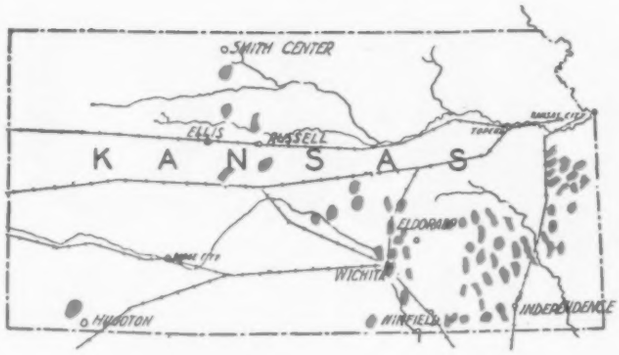
| Field | Completions | Type of Tools | Rigs | Drilling Wells |
|---|---|---|---|---|
| Oklahoma City | 100 | Rotary | 19 | 229 |
| Chandler | 5 | Rotary | 0 | 5 |
| West Asher | 3 | Rotary | 0 | 19 |

Of these fields the Oklahoma City pool offers the most difficult drilling proposition. Pressures here have dropped until the problems are not as large as previously. Pressures in the field now vary from 550 pounds in the older part to over 2,000 pounds in the north end.

* All statistics as of October 25th.

● **Denotes oil and gas fields.**

## KANSAS PRODUCTION, 1929—40,991,450 Barrels




One hundred eighteen tests were completed in Kansas the past month. At this time the state has 215 drilling wells and 31 rigs.

A summary of the active fields reveals that the Hugoton pool is the most active. Following is a summary of the three most active fields:

| Field | Completions | Type of Tools | Rigs | Drilling Wells |
|---|---|---|---|---|
| Hugoton | 29 | Both | 2 | 36 |
| Eastborough | 5 | Both | 8 | 21 |
| Rice County | 8 | Both | 1 | 15 |

Hugoton is located in Stevens and Morton counties in the extreme southwest area of the state. Drilling here is for gas production, where quite a large area has been proven.

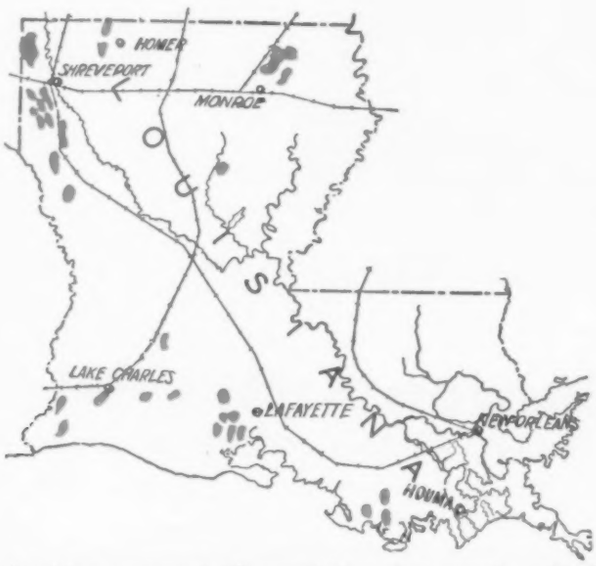
## ARKANSAS PRODUCTION, 1929—25,372,700 Barrels

Drilling operations in Arkansas are at the lowest point in a long time. There were only 12 completions last month, when 10 rigs and 42 drilling wells were carried on the scout reports.

Rotary rigs are employed to do the drilling.

This part of the United States is turning considerable attention to the Jackson, Mississippi, area, where important gains in activity have recently been made. The state reported only five completions last month. Mississippi has 8 rigs and 27 drilling wells.

## LOUISIANA PRODUCTION, 1929
## 21,172,000 Barrels




Louisiana reported 87 completions last month, with 50 rigs and 147 drilling wells. Of this number. 21 completions, 3 rigs and 45 drilling wells were in the Gulf Coast district and 66 completions, 47 rigs and 102 drilling wells were in the North Louisiana district.

Drilling operations are conducted with rotaries. Often times heavy gas flows give trouble in many areas, and many gas wells have been known to crater during wild flowing periods.

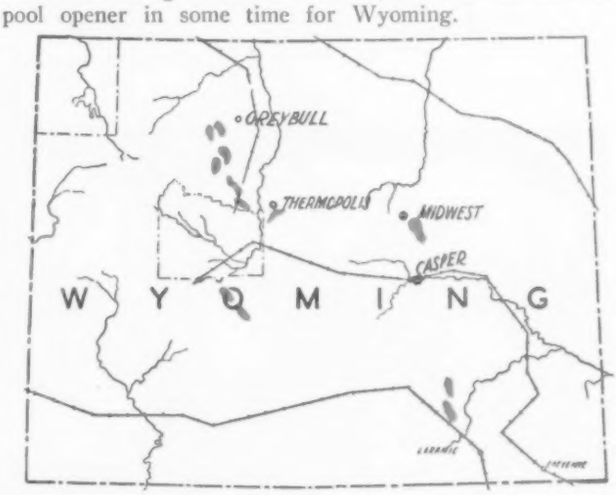
In the north area principal interest is in the Zwolle district, Sabine Parish. This area has proven very freakish, in that every test is practically a wildcat one as far as determining if it will find production.

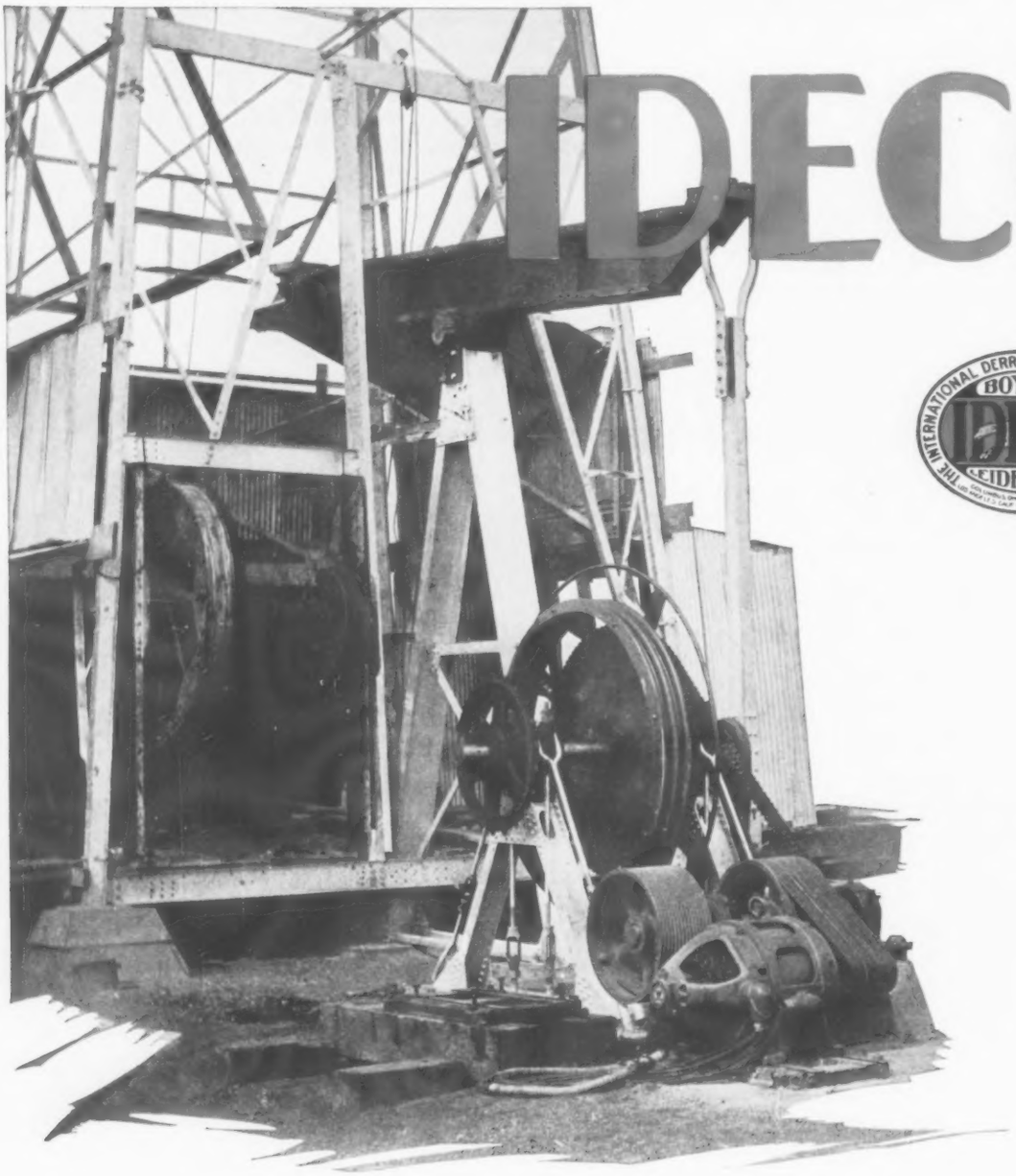
**●Denotes oil and gas fields.**

## WYOMING PRODUCTION, 1929
## 19,388,000 Barrels

The state drilling report of Wyoming shows 119 drilling wells and 28 rigs, with 18 completions the past month. Drilling is mostly done with cable tools with a few rotaries now being moved in for the deeper stuff.

The discovery well on Midway Dome, 12 miles north of Casper, which was drilled in last month, has been plugged back to shut off the water. Pumping equipment has been installed and it is ready for its first adequate test. Much interest is being shown in the test, as it is the first new pool opener in some time for Wyoming.

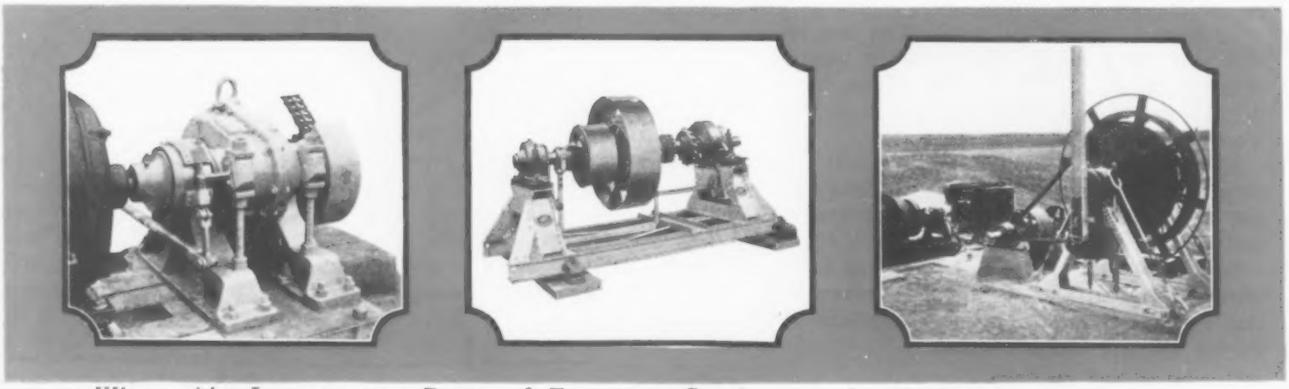





# The International Derrick

**Columbus, Ohio — Marietta, Ohio —**

New York Wichita Tulsa Oklahoma City Fort Worth
Houston Shreveport



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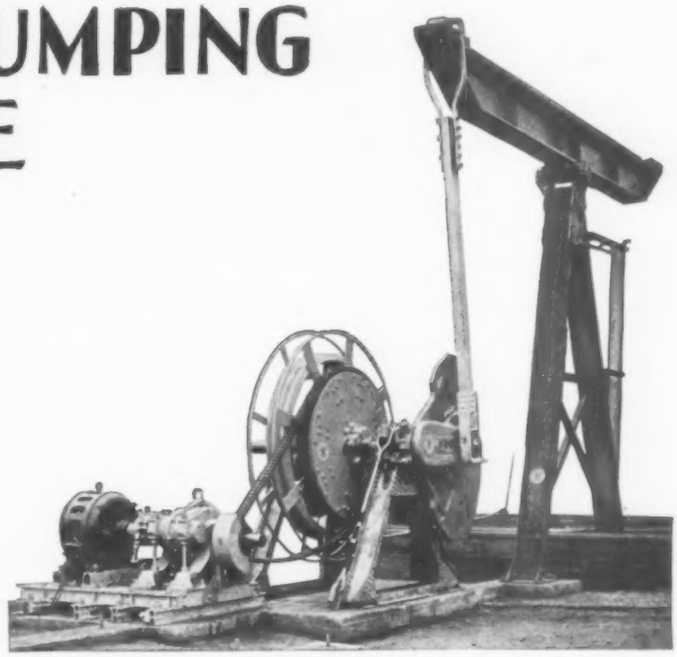
# CHAIN RIG

## DEEP WELL PUMPING SERVICE

IT is almost sufficient in itself to say that here is a portable, trouble-proof, deep well pumping (or cable tool drilling) unit that can be economically installed and operated, doing its work without faltering on the deepest wells.

Oil men everywhere have been awaiting the development of just such a unit as this IDECO Chain Rig. Its use means more hole per day and more production per well. A compact, powerful unit, built entirely of steel. Simplicity of design and unusual freedom from wear are outstanding features.

Write for Bulletin No. 101 giving complete details.



The IDECO Chain Rig may be operated with Electricity, Internal Combustion Engines or Steam Power. A complete IDECO Chain Rig consists of a chain wheel; crank and shaft; tapered wrist pin; standard "A" frame jack posts with roller bearings; "A" frame samson and headache post; center irons; walking beam; pitman and long stroke crank counterbalance; and the proper speed-reducing unit.

## & Equipment Company

**Beaumont, Texas — Los Angeles, California**

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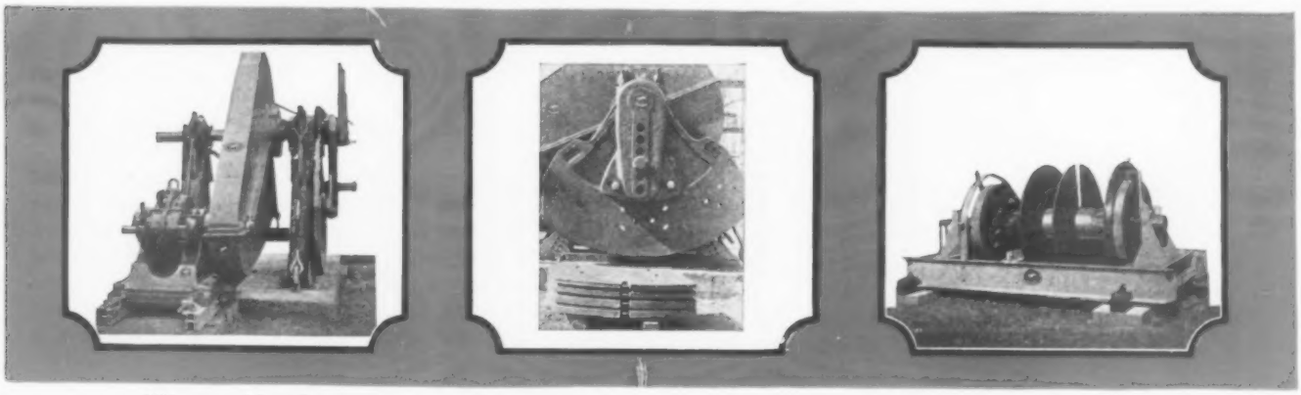
Branches in Every Important Oil Field



## NEW YORK PRODUCTION, 1929
### 3,346,000 Barrels

## PENNSYLVANIA PRODUCTION, 1929
### 11,905,000 Barrels

A total of 60 completions were made in Pennsylvania. Most of the activity is in the Bradford district. Nineteen wells were completed in this district and 18 in Clarion County. Outside of these areas the work is divided and consists mostly of semi-wildcats.

New York has nine completions, all producers.

## ILLINOIS PRODUCTION, 1929
### 6,304,000 Barrels

The state of Illinois had 10 completions, 2 rigs and 38 drilling wells last month. The drilling is being done with cable tools.

Right now most of the activity is in search of gas production. While the wells are not unusually large the completed gas wells are worth the connections being made to the gas lines running out of the area.

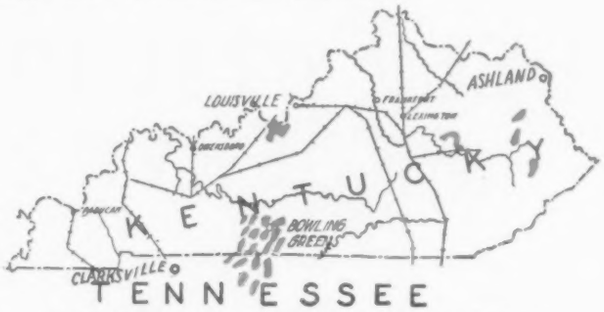
● Denotes oil and gas fields.

## KENTUCKY PRODUCTION, 1929
### 7,776,000 Barrels

The state of Kentucky reported 70 comp'etions last month. It has 8 rigs and 134 drilling wells. Most of the activity is centered in the Owensboro district.

In Tennessee there were 3 completions. There are 15 drilling wells, while only one rig was reported.

Cable tools are generally used for drilling in these two states, where production is quite shallow.




## TENNESSEE PRODUCTION, 1929
### 19,000 Barrels

## OHIO PRODUCTION, 1929—6,708,000 Barrels

Ohio had a total of 113 completions, of which 81 were in the central area, 19 in the southeast district, and 13 in the northwestern portion. The entire state has 43 rigs and 184 drilling wells. Cable tools are used practically entirely throughout this state.

## WEST VIRGINIA PRODUCTION, 1929
### 5,587,000 Barrels

West Virginia has a total of 105 operations, of which 87 are drilling and 18 rigs. During the past month the state had 87 completions. Cable tools do the drilling in this state.

There is considerable drilling in the proven area around Boone and Kanawha counties. Several other counties are competing with these in the drilling activities, and the work is pretty well scattered over the oil-producing area in the western and northern part of the state. The completions have offered nothing new. With the lowering markets and approach of winter operations are expected to show a decline.

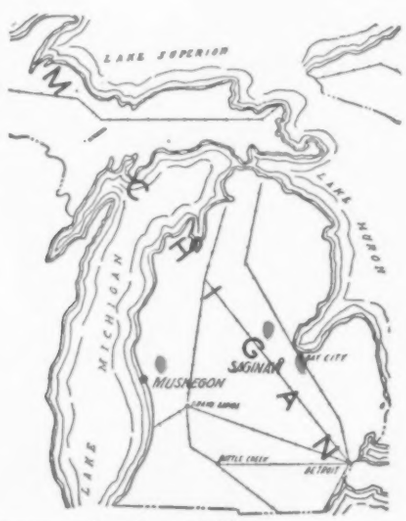
## NEW MEXICO PRODUCTION, 1929
### 1,395,600 Barrels

The Hobbs field of Lea County, southeastern New Mexico, has placed this state in the limelight. The state had 29 completions, 23 rigs and 108 drilling wells last month, of which 25 completions, 18 rigs, 78 drilling wells were in the Hobbs field.

Hobbs is one of the most active spots in the land. Difficult drilling, because of several upper gas horizons carrying large pressures, demand careful attention to operations, including increased mud weight, etc. Heavy type rotaries are used altogether. Inability to move the crude out and efforts at proration are holding operations down to the minimum, as normally there would be several times as many operations.

Recent completions in the pool have indicated that considerable more production awaits the bit on the east, west and north sides of the present producing area. The structure is now proven for five and one-half miles southeast by northwest with an average width of nearly two miles.

## MICHIGAN PRODUCTION, 1929
### 4,500,000 Barrels



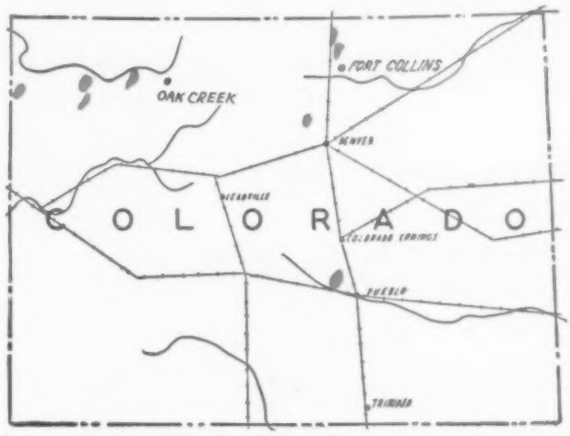

Thirty - five completions, 51 rigs and 104 drilling wells was the record for Michigan last month. New locations have been showing a sharp decline in the state, and this will soon affect the number of completions and wells.

● Denotes oil and gas fields.

## MONTANA PRODUCTION, 1929
### 3,926,650 Barrels

Montana has 87 drilling wells and 23 rigs and locations. The past month the state had 25 completions made. Both cable and rotary tools are used in the state, the former being used on the shallower tests.

## COLORADO PRODUCTION, 1929
### 2,372,100 Barrels




Colorado showed only 6 completions last month. The state has 12 rigs and 81 drilling tests.

The most important discovery recently has been in Weld County on Greasewood Dome where a well has been flowing about 50 barrels hourly by heads without being finished.

Rotary tools predominate in the state.

## INDIANA PRODUCTION, 1929
### 977,000 Barrels

A slight increase in the number of completions the past month over the previous month was registered in Indiana, however, other activity showed little or no change. The state had 24 completions, 5 rigs and locations and 50 drilling wells. Cable tools are the standard method of drilling tests in this state.

# WRITE
# A FEW WORDS
## and you may win CASH

Many drillers, superintendents and others acquainted with the service of Bettis Protectors and Drill Stabilizers have written interesting letters regarding the performance of our products. As an incentive for you to give us your ideas or relate your experiences with Bettis products, we are offering $400.00 in cash prizes. What services have Bettis Protectors performed for you? Have you had some unusual experience? Just write us a simple letter and you may win one of the 20 cash prizes.

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# Bettis Protectors

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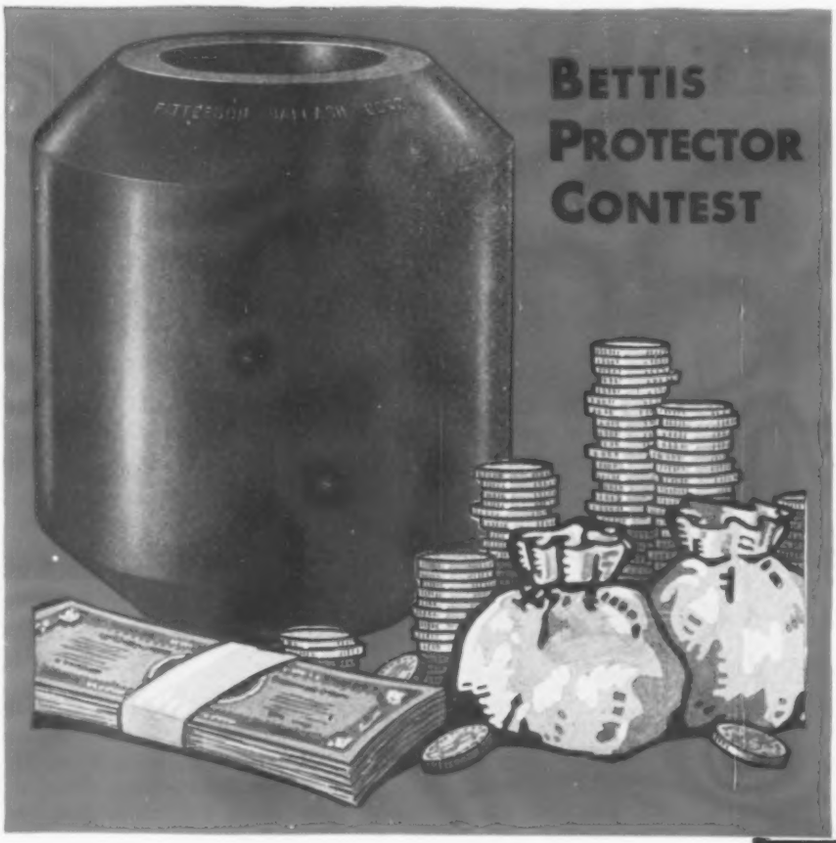


"Best bet yet"

**RULES OF CONTEST**

No letter or statement over 300 words. All statements must be truthful. Contestants must mail letters not later than December 31, 1930. In the event of a tie for any prize, same award will be paid to each.

| | |
|---|---|
| 1ST PRIZE | $200.00 |
| 2nd PRIZE | $75.00 |
| 3rd PRIZE | $25.00 |
| 4th PRIZE | $15.00 |
| 5th PRIZE | $10.00 |
| NEXT 15 | $5.00 |
| TOTAL | $400 |

# & Drill Stabilizers

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# Progress of Major Pipe Line Work

## GREAT LAKES PIPE LINE CO.

WITH cold weather just around the corner, the progress reports on the major pipe lines under construction show each well under way with their programs. As will be noted by the red lines indicating the progress of the various lines, one program is virtually completed and several of the others are in a position to be finished, or in the finishing stages, by the arrival of the holidays.

***Great Lakes.***

The five contractors building the 1,440-mile welded gasoline line for the Great Lakes Pipe Line Company have approximately 175 miles of pipe in the ground. Construction work has been started on four stations.

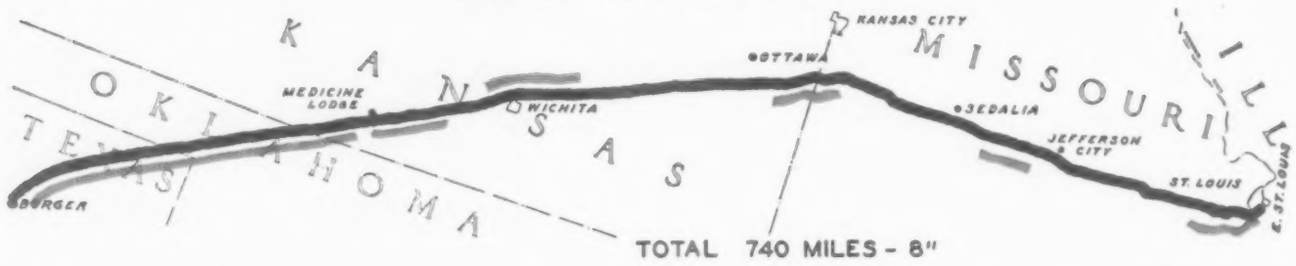
***Phillips.***

Kelly-Dempsey, builders of the 740-mile welded 8-inch line for the Phillips Pipe Line Company, are in a position to complete that gasoline carrier by Christmas.

***Gulf.***

The Gulf Pipe Line Company has approximately 150 miles of its 1724 miles of main 10-inch welded line to complete. Alternating stations on the line are nearing completion. This line will terminate at a point near Spencerville, Ohio, and the Gulf Company will move crude to Toledo and other eastern points through the Buckeye Pipe Line Company system. Upon completion of the main 10-inch, a 49-mile 8-inch welded lateral will be built south to Cincinnati.

## PHILLIPS PIPE LINE CO.

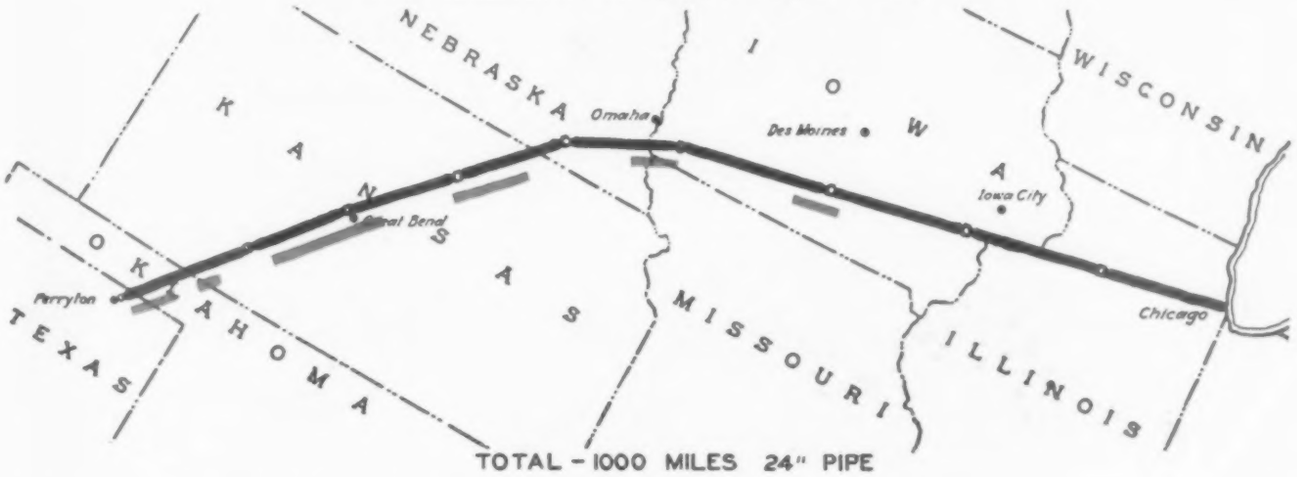



## GULF PIPE LINE CO.

## AJAX PIPE LINE CO.

Exactly 137 days after arriving in Tulsa and starting to set up an organization, the Ajax Pipe Line Company pumped oil at one of its stations on the west end of the line. This double 10-inch gas welded carrier, running from Glen Pool to Wood River, Illinois, will have a daily capacity of 65,000 barrels and is being built by the Oklahoma Contracting Company. The Ajax is building its stations, and the entire project is 70 per cent complete.

## CONTINENTAL CONSTRUCTION CORP.



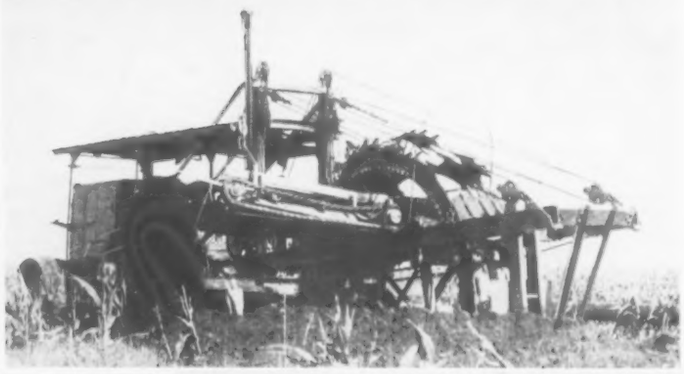

Continental Construction Corporation, builders of the Panhandle-Chicago 24-inch combination coupled and welded gas line, are moving along rapidly on this mammoth gas project, involving an investment of $100,000,000.

## MISSOURI-KANSAS PIPE LINE CO.

Missouri Kansas Pipe Line Company is nearing the end of its field work and the gathering system in Texas and is well along with the construction work on the 24-inch main through Kansas. Construction work also is progressing in Missouri and Indiana.

**Indicates completed portion of line.**
**Indicates proposed route of line.**

# The TOUGHEST INSPECTOR CAN FIND NO FAULT WITH TRUMAN-SMITH Lines

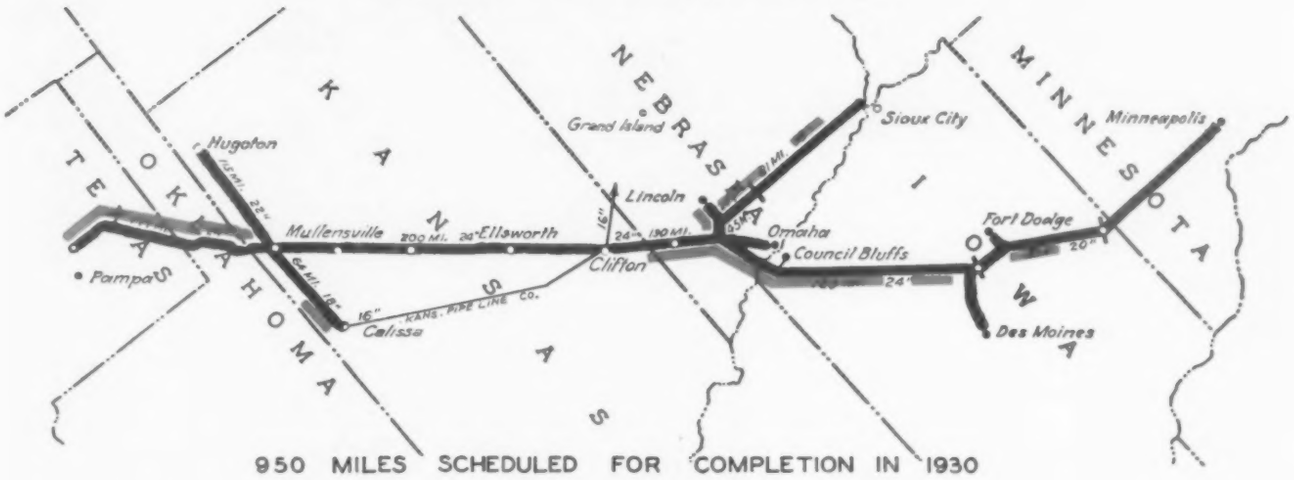


—they are Dresser coupled, screwed, or welded, doped and laid right—

That's Why!

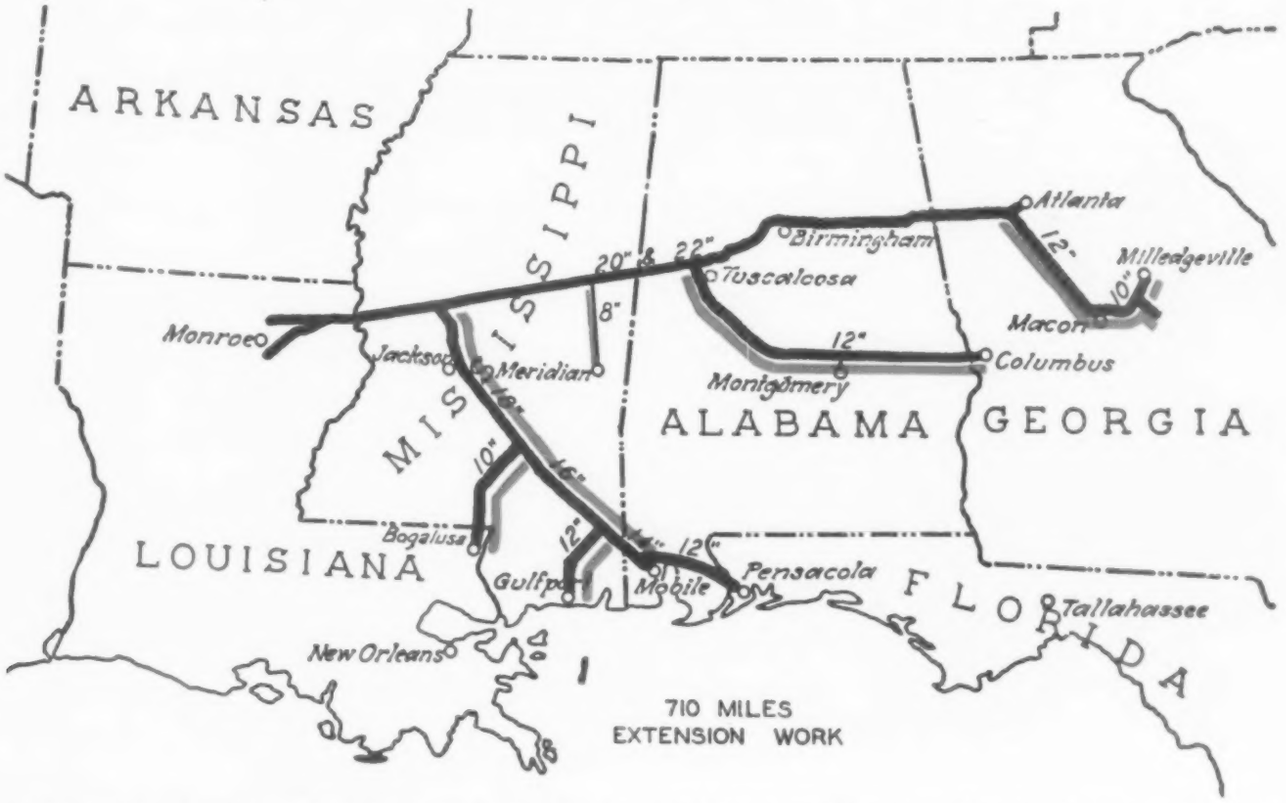
## The TRUMAN-SMITH CONST. Co.
EL DORADO, KANSAS.

## MISSOURI VALLEY PIPE LINE CO.




Missouri Valley Pipe Line Company is nearing the end of its 1930 construction program in building a 24-inch gas line from the Texas Panhandle through Kansas into Nebraska and Iowa. The line is complete from the Panhandle to Mullinsville, in Kansas. The 22-inch from that point west to the Hugoton field is not to be completed until 1931, nor is the 200-mile section of 24-inch from Mullinsville north to Clifton to be built until next year. Instead of working on these two sections this year, 64 miles of 18-inch line is being built east from Mullinsville to Galisa, and the Kansas Pipe Line Company 16-inch line will be used to deliver gas to Clifton.

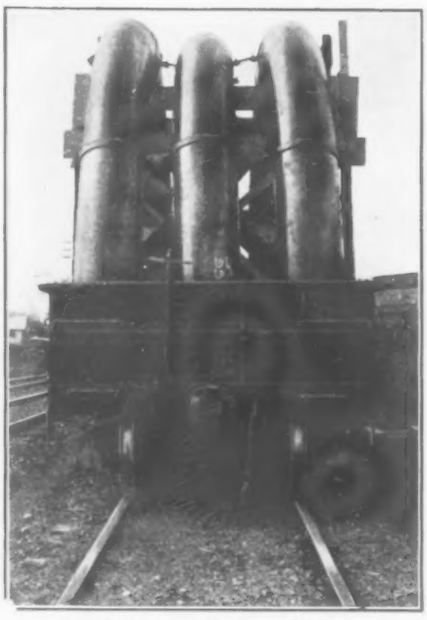
## SOUTHERN NATURAL GAS CORP.




The project virtually completed is that of the Southern Natural Gas Corporation, which has added approximately 700 miles of main line system to its trunk system running east from the Monroe, Louisiana, field to Birmingham and Atlanta. All of the main lines have been completed except the 60-mile extension from Mobile, Alabama, to Pensacola, Florida. This extension will consume considerable more time because of the difficulties encountered in building a line through such an exceptionally swampy country as found along the right-of-way for the 12-inch system.

**Indicates completed portion of line.**
**Indicates proposed route of line.**

# Complete Service in PIPE FABRICATION



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Complete piping for refinery, pumping or compressor station.

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WHEREVER you are—in your own city or near you is a Grinnell office or a distributing branch.

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## GRINNELL TRIPLE XXX PRODUCTS

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# The Month's Activities *in* Refining*

REFINERS continue to install more efficient equipment for improving the quality of finished products and reducing operating costs. Stabilization and cracking are receiving more attention since many refiners are improving the volatility and anti-knock properties of their non-premium gasoline.

Due to the variation in knock rating and gum-forming tendencies of the various fractions in gasoline distillates, it is often more economical and effective to treat some fractions separately, since they do not all require the same degree or kind of treatment.

A new type of furnace design for both cracking and pipe stills consists in installing tubes on the floor of the main heating chamber, so connected to be located in any part of the oil flow, in order to give the desired heating curve. The heat application to the floor tubes is entirely by radiation. Several installations in operation for some months have effected as much as 50 per cent increase in throughput at lower furnace temperatures, with no other change in the furnace than an increase of about 8 per cent in the heating surface.

Many manufacturers of bright stock are producing zero cold oils. Direct expansion systems for cooling to minus 40 or 50 are installed. The centrifuge is most widely used for dewaxing. The use of solvents and filter aids is as yet limited.

A process for the revivification of spent contact clay by means of a solvent which removes the tarry residue from the filter cake, has been developed and should effect a great reduction in contact filtering costs.

### *Natural Gasoline*

The report on natural gasoline, released October 22nd by the Department of Commerce, shows a new record for the industry; the production for 1929 was 23 per cent over the 1928 output. The quantity represented 10.7 per cent of the total gasoline production of the country. About 93 per cent was used by refiners for blending.

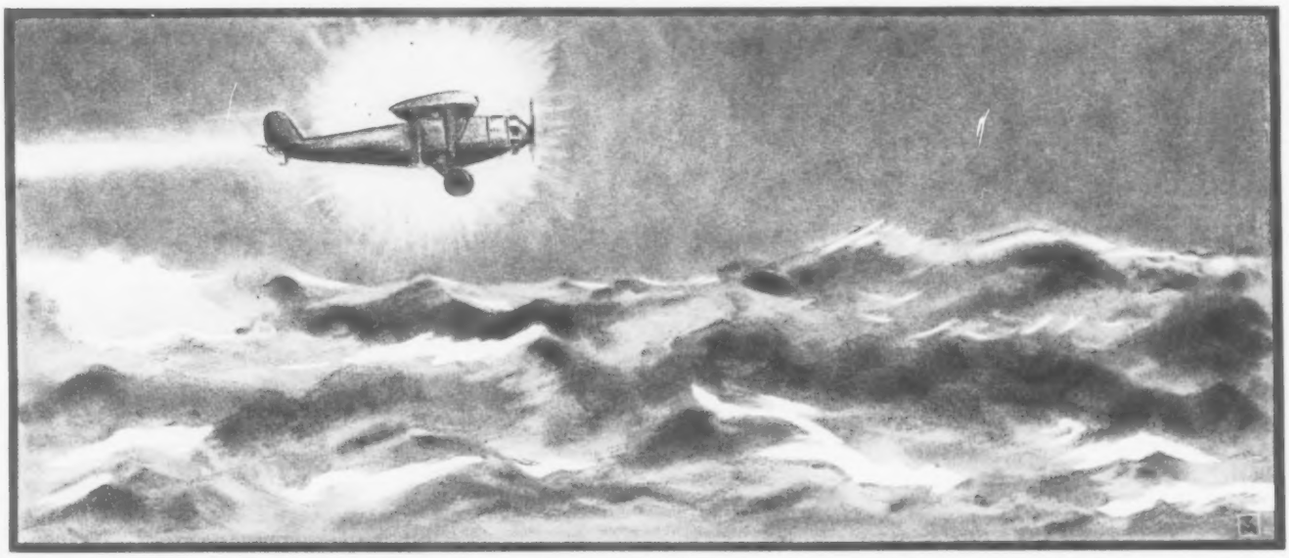
The program committee for the Convention of the Natural Gasoline Association, to be held in Tulsa during May, 1931, will consist of S. S. Smith, Shell Petroleum Corp.; George P. Bunn, Phillips Petroleum Co.; E. W. Zublin, T. P. Coal & Oil Co.; and W. W. Robinson, Jr., The Texas Co. (Calif.).

The technical committee on lubricants and liquid fuels for the Federal Specifications Board decided against giving a new name to the regular gasoline now called U. S. Government Motor Gasoline. It also decided not to increase the Reid Vapor Pressure limit on this product to 12 pounds. Since many state regulations use the U. S. Government Motor Gasoline specifications, the 10-pound vapor pressure limit means that such a motor fuel may lack proper volatility for satisfactory cold weather performance.

Figures in red show per cent refining capacity operated.

* All statistics as of October 25th.

# THE WORLD'S GREATEST UNIONS



## AMERICA AND EUROPE---*BY AIR*

**Airplane flights across the ocean seemed an impossibility until the daring exploit of a now famous young aviator convinced the world once again of the truth of the saying: "Nothing is impossible."**

**Some construction engineers have gone along for years experiencing chronic troubles with unions, convinced that it was impossible to escape them, until Jefferson Unions changed their conviction.**

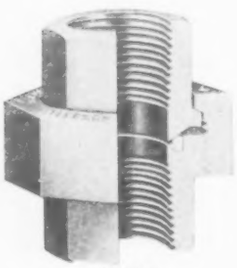
**Jefferson Unions are manufactured from Air Refined, Certified Malleable Iron, made in our own foundry and tested for a uniform tensile strength of 50,000 pounds. The finest brass tubing is cut into seat rings, which are located in a recess, away from the runway of the fitting, there finding protection from abrasion and corrosion occurring in the runway. Joints are spherical, ground in pairs and never separated. Brass becomes one piece with the iron when fitting is tightened; gaskets unneeded. Play between nut and swivel end provides easy application even when pipe stems are out of alignment. Coarse threads are graphite coated, for 100% salvage value. Jefferson Unions are furnished with iron to iron joints, as well as brass to iron, at no extra cost, when specified for use in oil fields where a highly corrosive condition exists.**

*Handled By All Leading Oil Industry Jobbers*

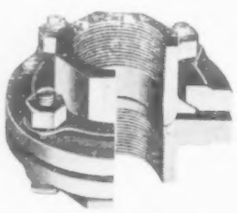
**Jefferson Union Company**

LEXINGTON, MASS., U. S. A.

Sales Offices: 11 W. 42nd St., New York, N. Y.



Style "A"
W. P. 300 lbs.



Style "B"
W. P. 200 lbs.

Style "D"
W. P. 500 lbs.

Style "E"
W. P. 1000 lbs.

# JEFFERSON

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*Developments in . . .*

# Hard Facing Rotary Bits in California

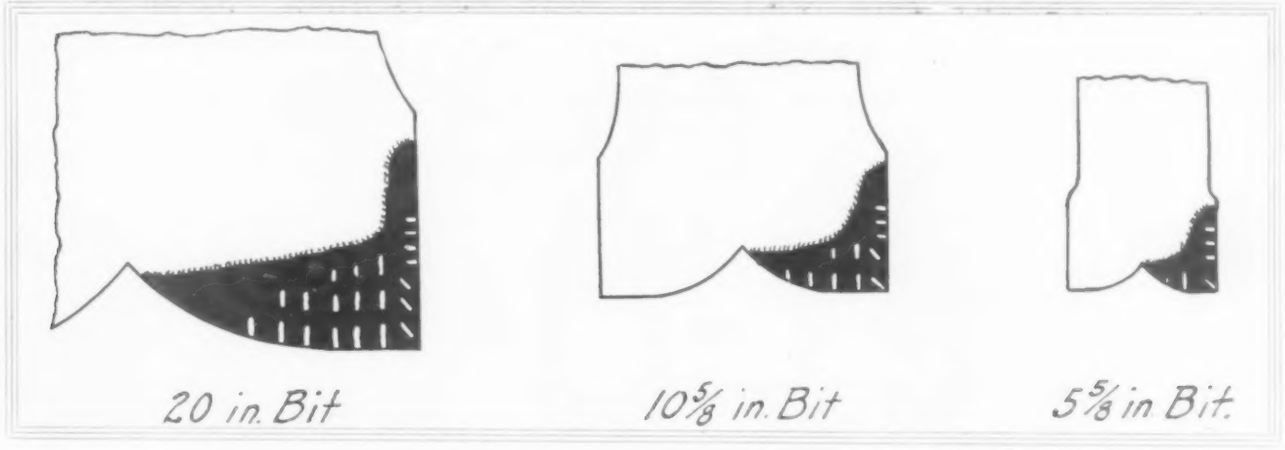
*By* W. A. SAWDON, *Petroleum Engineer, Los Angeles, California*

IT is not much more than a year or two since the so-called diamond substitutes—extremely hard inserts—were coming into vogue for augmenting the cutting power and lasting qualities of drilling bits. A trend is now evident in the California fields toward the use of the same "diamond-hard" substance in granular or powdered form with a more even distribution over the entire cutting edge of the bit and a prevention of fingering as caused by the more rapid wear of the less resistive material which surrounds the hard particles and which is necessary for keeping the inserts in place. Hard-facing material, as distinguished from the diamond-hard compound, has not by any means been eliminated, and the insert is still preferred by many companies. Yet the tendency toward a wider use of the smaller particles is evident and the various manufacturers are meeting the demands by furnishing the metal in all sizes desired.

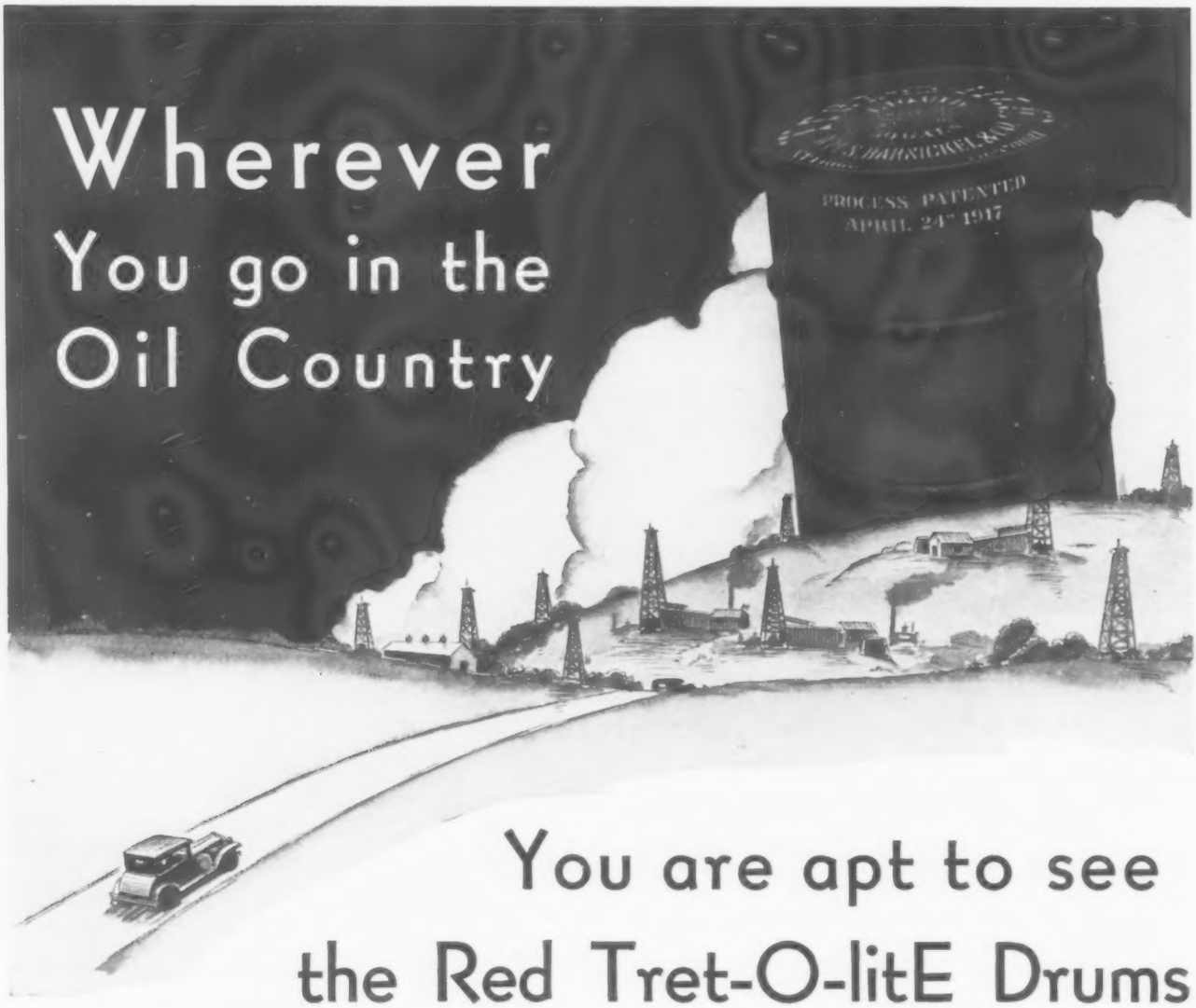
This disc was faced with the granular type of diamond-hard compound and is shown after making 539 feet at the 3,000-foot depth in Signal Hill. The case-hardened disc itself is shown in a worn condition with the facing standing up around the edge.

The hard facing of drilling bits has been more or less of an evolutionary process. The welding up of a bit with high carbon steel was found to be much more satisfactory than forging it back into shape. The hard-facing material was then applied to the parts subjected to the greatest wear. After that came the use of the so-called diamond substitutes or inserts composed of material which was much harder than the hard facing alloy. This could not be welded directly to the base metal of the bit, but relied on a bed of hard-facing material, or even high carbon steel, to keep it in place. Probably coinciding to some extent with this last, but recently being given more attention, was the granular and powdered forms of diamond-hard compounds.

Considering the diamond-hard substances alone, there is considerable difference of opinion in the California territory as to the relative advantages of inserts, granular form and powder. Actually, the compounds used are slightly less than "diamond-hard," but they are so specified here to distinguish them from the hard-facing materials which can be melted and which usually contain more or less iron in their base. Some claim a desirability in sorting out the sizes in the granular form for different parts of the tool; others prefer an even spread of the compound as can be obtained with both the granular and powdered forms; and still others feel that the advantages of the insert outweighs its possibility of breaking off or falling out when the encasing material has been worn away. A careful investigation has shown some remarkable results obtained by the use of each and every form of diamond-hard compound; but it also shows that a direct comparison is difficult to make, since it is almost impossible to




The location of inserts for three sizes of fishtail bits is here given as recommended by one manufacturer.

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You won't see many of them perhaps - - - for but little Tret-O-litE is required to recover a lot of oil. But where "cut oil" is present the first commercially successful treating method is still the most widely used » » » » Simplicity, rapidity, economy, thoroughness and *certainty of results* commend the Tret-O-litE process to the great majority of experienced operators » » » » And wherever "cut oil" is encountered a Tret-O-litE representative is at hand - or can be there - bringing the vast experience and resources of the Wm. S. Barnickel & Company organization.

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obtain records in the same formations and in the same fields that were obtained under even similar conditions without involving competitive makes of material.

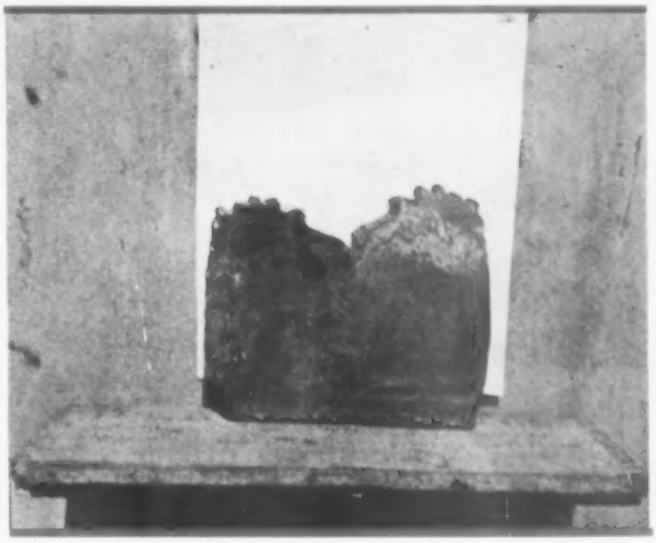
It must be remembered that in most cases the granular form consists of a great number of very small inserts that rely on the hard-facing material in which they are imbedded and surrounded for their adhesion to the parent metal; but that some powdered forms, when put on with the intense heat of the electric arc, may be used without any other medium and become bonded with the bit metal itself. In studying the service rendered by bits faced with diamond-hard compounds and those with hard-facing material, the former has sometimes established excellent records, especially when used in sharp, abrasive formations. In rough conglomerate, however, there is probably no advantage if inserts are used, since the inserts will be broken off more readily. There seems to be an advantage, in this particular instance, in the use of the granular or powdered form, although some chipping may decrease the ratio.

The discs of this bit were faced with a diamond-hard compound while part of the body was built up w th hard-facing material.

The chief function of the drilling bit is to cut or crush the material which it encounters in making the hole. The cutting edge must, therefore, have the greatest resistance to the abrasive action of the formation, yet the bit itself must be tough enough and strong enough to resist the stresses to which it will be subjected. The hard-facing material may not sacrifice as much toughness as will the diamond-hard compound, and possibly will not give as highly abrasive action. The diamond-hard metals consist of some form of tungsten carbide and are brittle. So the selection of the best type of facing to use on the bit will be governed by whether a very hard cutting edge with brittleness is more desirable or whether some of the hardness should be sacrificed for a less degree of brittleness. With the harder formations being encountered in the deeper drilling being done in California, the harder material is being used more widely and it is felt that the application of the diamond-hard compound is a matter of economy.

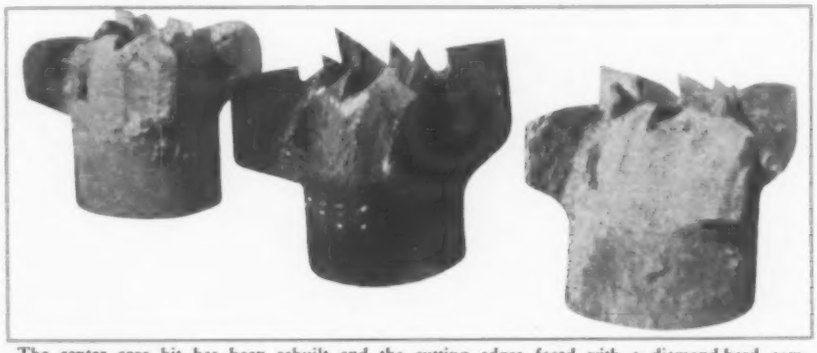
The value of the use of hard-facing material or diamond-hard compounds is now well recognized and very few of the manufacturers of fishtail, disc or patented types of bits in California send the tools out without one or the other in some form. Some of these standardize on inserts; others use either granular or powdered diamond-hard metal only, and still others supply what the purchaser specifies. Many of the patented type or specially-designed bits are rented to the operator and when worn are built up and faced by the manufacturer alone. With bits that are sold, the companies either reface them in their own shops or job them out to welding shops that are located in all the fields and which specialize in this type of work.

The economic factor is, of course, of great importance. In considering the advantages of hard facing or diamond-hard metals, the first cost, the cost and ease of application, the expense of renewal, and the service which will be given must be accorded due weight. These factors, however, pertain more to the selection of the type of facing material to be used rather than to a decision to use *a* facing material. There are few instances where the use of a facing material has not been of the greatest advantage. With an increase in the time in which a bit is kept in the hole and the accompanying greater depths made in that time, there are many economies obtained. The round trips to replace bits are fewer and this reduction makes for even increased speed as the hole becomes deeper. There naturally follows a decrease in labor, fuel and water costs and in wear and tear on equipment. The bits last longer and are dressed less frequently. Increased speed, of course, lowers the drilling time and costs and also gets production sooner.

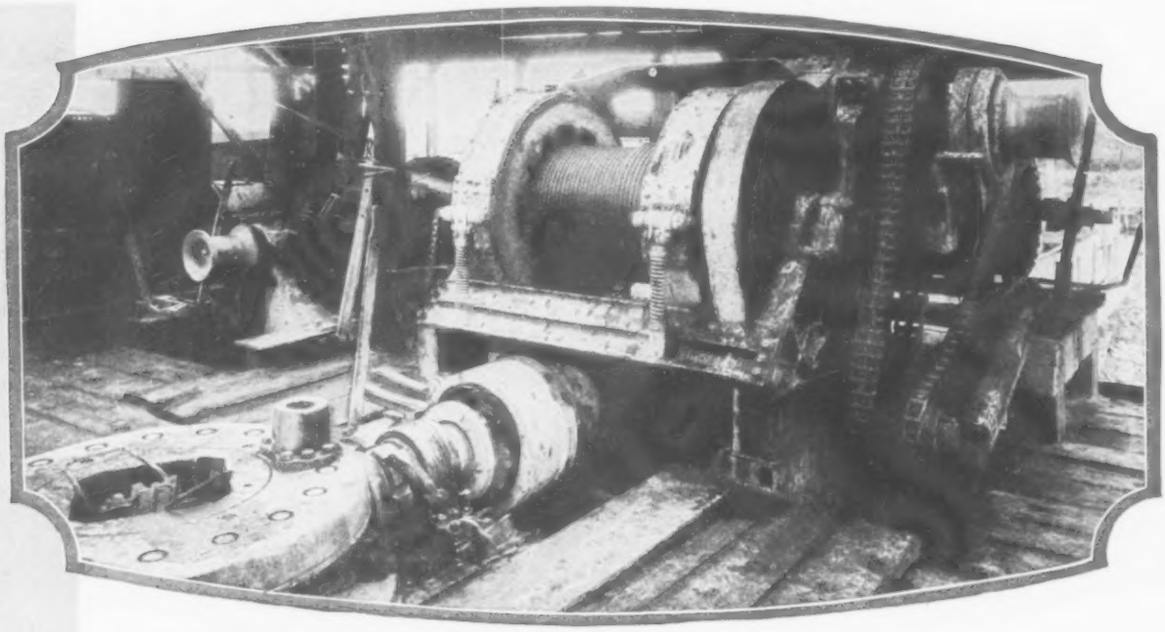


The fingering of diamond inserts on a fishtail bit after reaming 400 feet of hole and making an additional 60 feet in the Long Beach Field.

A very important factor, however, is the keeping of the bit to gauge. The function of a hard-facing or diamond-hard compound in this respect must be given consideration. In almost every case where investigations have been made, the bits which were properly faced with such materials have held their gauge to a remarkable extent. This has been of great assistance in keeping holes straight and has eliminated the ne-



The center core bit has been rebuilt and the cutting edges faced with a diamond-hard compound. To the right of it is a core bit after having made two runs in the Venice Field. The first run was for 29 feet in shale and sand for twenty minutes, the second produced a core of 25 feet of shale and sand and ten inches of shell in one hour. To the left is a bit that cored for three hours in the Signal Hill Field from 5,521 feet to 5,527 feet. Both of these bits were faced with diamond-hard compound.



*Type H Machine drilling in Louisiana using gasoline engines for power. Note reverse gear to left of machine and the chain drive to the bailing reel which is mounted back of the draw-works.*

# Sheldon-Burden Type H Rotary Drilling Machine

A GEAR-DRIVEN deep well rotary drilling machine with principal parts mounted on one substantial steel base to provide quick and easy moving and rigging up. Rotary table, draw-works, and steam engine or electric motor are easily removable from base and transported as separate units when desired.

Special high-speed steam engine or electric motor and gear box are mounted back of draw-works on the steel base of the machine when steam or electric power is used. When gasoline or Diesel engines are used, the reverse gear is mounted in the corner of the derrick and the chain from it is connected to the rear shaft of the machine. The engines (and double hook-up if desired) are placed on the ground or on a platform alongside of the derrick.

The rotary table is shaft-driven and controlled by a friction clutch which can be set to slip before the pipe twists off. The friction clutch can be instantaneously engaged or disengaged at any shaft speed, thus making for ease of operation and safety.

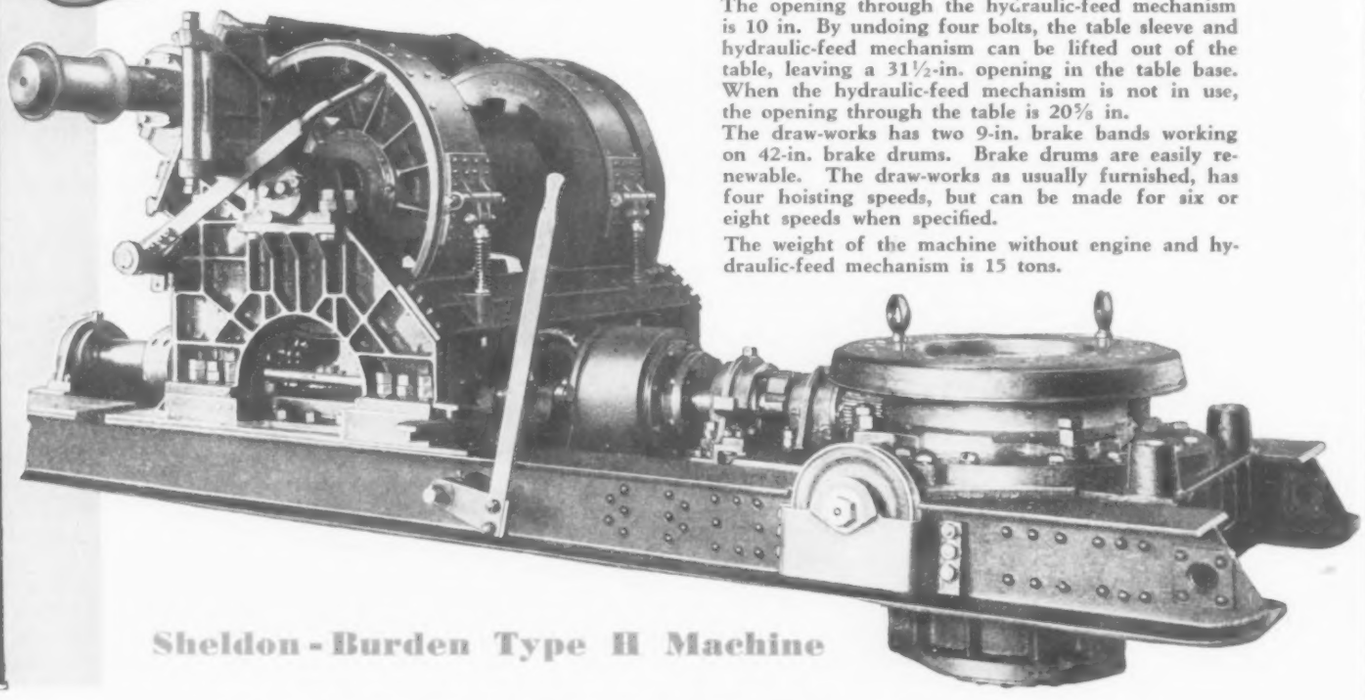
The shaft drive to the table eliminates the usual chain across the derrick floor and permits a wide range of table speeds from the slowest up to 250 r. p. m.

The rotary table may be used as a regular rotary table or with the Sheldon-Burden Type Hydraulic-Feed Mechanism.

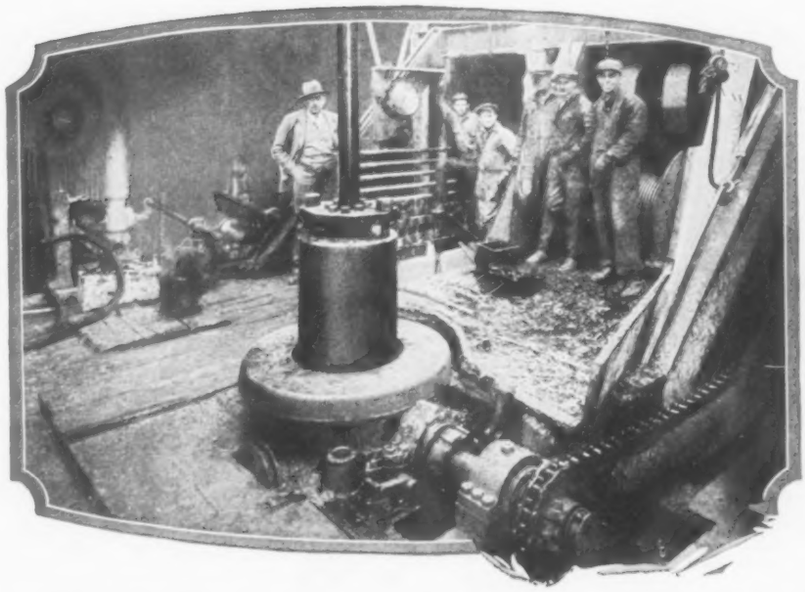
The opening through the hydraulic-feed mechanism is 10 in. By undoing four bolts, the table sleeve and hydraulic-feed mechanism can be lifted out of the table, leaving a 31½-in. opening in the table base. When the hydraulic-feed mechanism is not in use, the opening through the table is 20⅝ in.

The draw-works has two 9-in. brake bands working on 42-in. brake drums. Brake drums are easily renewable. The draw-works as usually furnished, has four hoisting speeds, but can be made for six or eight speeds when specified.

The weight of the machine without engine and hydraulic-feed mechanism is 15 tons.



**Sheldon-Burden Type H Machine**



*Drilling in Canada at depths of over 5,000 feet with rock bits in hard lime. Gas pressure up to 2,500 lbs. were encountered. Straight holes were drilled where other equipment was unable to complete the wells due to crooked holes, and frequent sticking of the pipe from settlings.*

# Sheldon-Burden Type HR Rotary Table

## for use with any regular type draw-works and engine

TYPE "HR" Rotary Table is designed for use with any of the regular type rotary rigs. This permits you to get many of the advantages of the hydraulic-feed mechanism while still using the old type equipment. Some of the many advantages of the Sheldon-Burden Type Hydraulic-Feed Mechanism are:

(1) Drills straighter holes more easily.
(2) Can drill upward through cavings.
(3) Can press downward on the bit to make up for lack of pipe weight.
(4) Increases footage obtained from various type bits by keeping accurate and proper bit pressures.
(5) Can be used as 100-ton capacity hydraulic jack when working stuck pipe.
(6) Indicates immediately when passing from soft to hard formation or vice-versa.
(7) Is a super-sensitive and accurate weight indicator.
(8) It can keep pipe moving while making connections or in case of machinery break-down.
(9) Feeds and rotates drill pipe while working against well pressure.
(10) Micrometer feed of hydraulic-feed mechanism produces better cores with less shattering or burning.
(11) Accurate feed of drill pipe assured regardless of depths and weight of pipe.
(12) Eliminates all rotating load on swivel bearing while drilling.
(13) Increases efficiency of the driller by giving accurate feed control without his holding the brake lever for long drilling periods.
(14) Permits safe snubbing of pipe out of hole against high well pressures.

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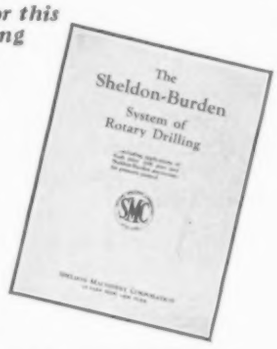
**SHELDON-BURDEN TYPE HR ROTARY TABLE**

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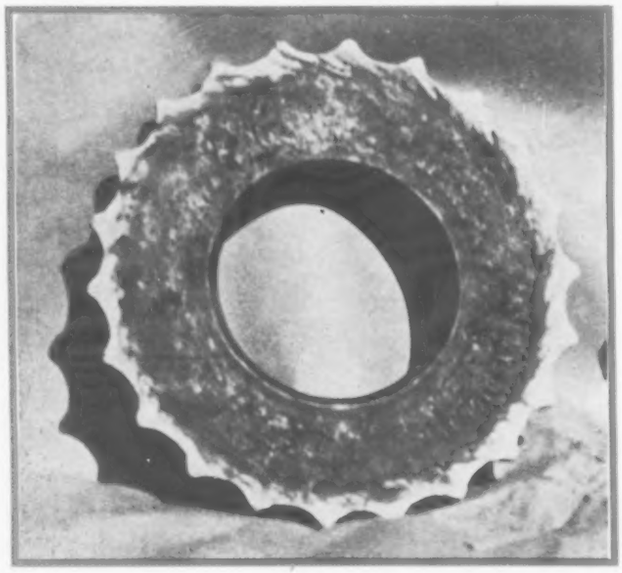
*Distributors:* Oil Well Supply Company, Lucey Products Corporation



**The wearing away of the hard-facing material from the inserts used around the edge of a disc bit is clearly shown.**

cessity of reaming. It has, moreover, been the probable means of reducing fishing jobs; and an insurance against such a hazard would make the use of a hard-facing material well worth while.

As mentioned above, it is practically impossible to specify any ratio of increased footage that could be expected by the use of a hard-facing or diamond-hard metal for any particular formation. Some interesting results have been reported, however, and these may well be cited. In the Buena Vista Hills a well drilling through shale and sandy shale made 30 feet in 11 hours with a shop-dressed and tempered bit which was worn blunt when taken out. A hard-faced bit then made 140 feet in 36 hours and was but 0.1 inch out of gauge when changed. In the same field, but in another well, shop-dressed and tempered bits made five feet with 3.5 round trips per day, against hard-faced bits making 15 feet with only 1.5 round trips per day.

In the Long Beach field a fishtail bit using diamond-hard inserts was used to ream 400 feet of hole which had been drilled with a core bit. This was at the 6000-foot depth and the bit was kept in to drill 60 feet more through sandy shale and shells. Its condition when pulled is shown in one of the accompanying illustrations.

A disc bit in Signal Hill which was faced with granular diamond-hard compound was run in at about 3,000 feet. It made 539 feet in 33 hours and came out in the shape shown by the picture of one of the discs.

The application of hard facing and diamond-hard compounds varies somewhat and each manufacturer offers recommendations for his particular product that should be followed to obtain the best results. Acetylene welding is better for some types while electric arc welding gives more satisfactory jobs with others. Some materials even demand the use of the acetylene torch while others can be applied only with the arc.

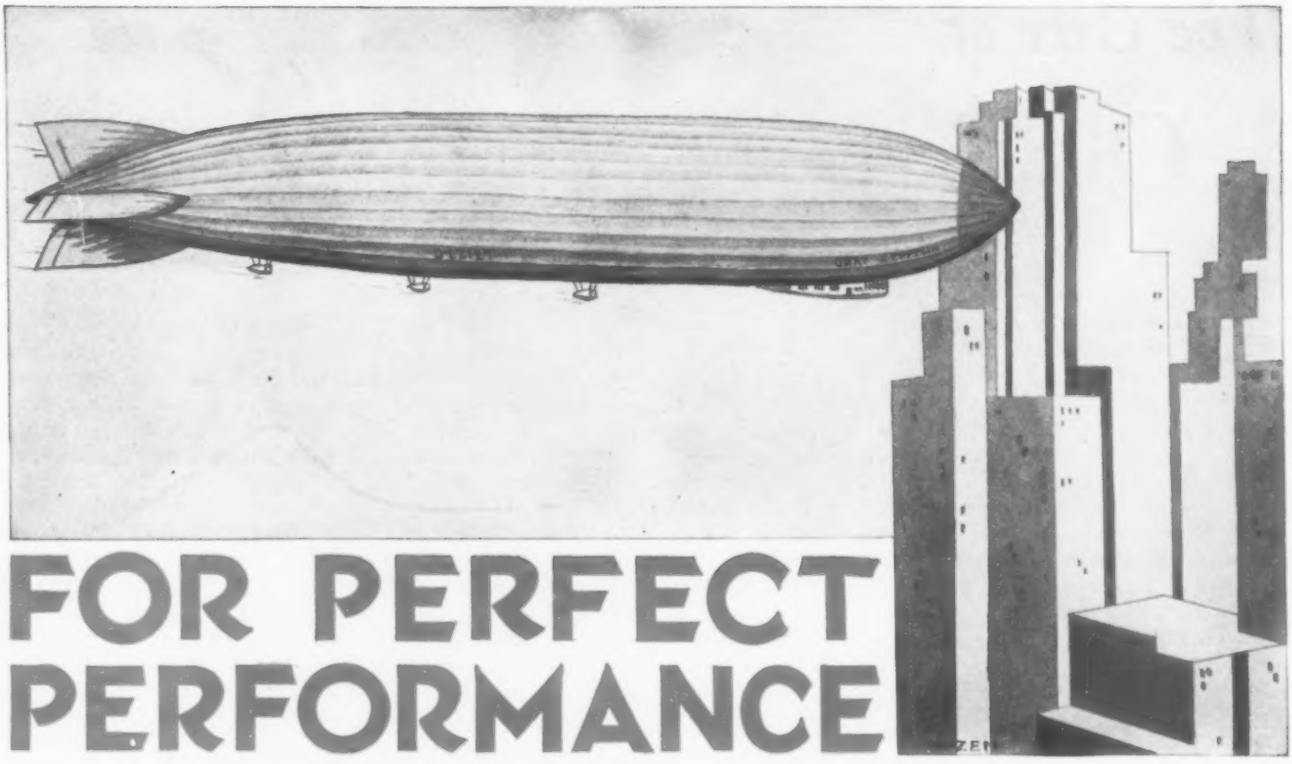
The hard facing metal is generally an alloy with an iron constituent in its base in a greater or less amount. It must be self-hardening and require no heat treatment or tempering. It is naturally too hard to be machined, but it can be ground down. Its main function is as a resistant against abrasion yet it must be able to stand shocks and stand up under compression. The main body of the bit must be designed to take care of the various stresses to which it must be subjected, but the cutting edge formed of the hard-facing material must be able to resist fracture and must have the necessary cohesion to stay on the parent body of the bit. Its coefficient of expansion should approximate that of the steel of the bit so that when cooling after the welding process has been completed there will be no danger from cracking off.

Diamond-hard compounds when used in the insert form necessarily rely on a hard-facing material or a special bonding alloy to keep them in place on the bit, although high carbon rods have been used for this purpose. A recess is generally made to take the insert and the encasing metal is welded around and over it. Practically all these inserts are tungsten carbide and are not melted at the temperature applied in the welding operation. Being harder than their encasing metal, they do not wear as rapidly while drilling and will stick up like fingers or points after the bit has been in service for a long time. Danger of breaking these projections off or losing the insert naturally arises and offers an objectionable feature. This is evident in some of the accompanying illustrations. Many companies find inserts very successful and some of the patented bits use them with great success because of the arrangement of the cutting faces and their adaptability to the concentrated hard spots. With some fishtail bits the position of the inserts are located differently on each fluke in order to break up the cut.

The granular and powder forms of diamond-hard compounds give a very even distribution over the bit. They are particularly applicable to disc and fishtail bits, although they are becoming quite widely used on special designed types. A hard facing metal or alloy steel can be used with the granular form for welding on to the body of the bit and different sizes of granulated compounds are available for different purposes. These are really small inserts, but are so spread over the portion being faced that they make practically a continuous diamond-hard edge. It is probably better to use a hard-facing material as the binding element for this type of metal, but some operators prefer the high carbon rod and have found it successful.

Some forms of powder, although having no iron base and being a tungsten carbide, can be melted at a temperature but little above that for hard-facing metal. They are applied directly by arc welding to the bit without the use of a binding metal. In fact they do not attain diamond-hardness until after the electric arc has been applied.

**The crimped disc here shown is set with inserts at each high point.**



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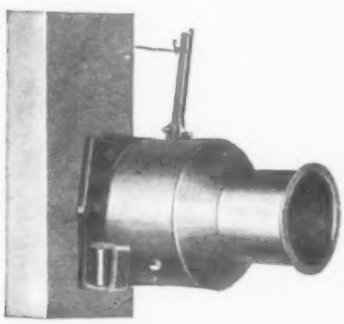

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# *The Care of* Oil Field Trucks In Winter

*By* H. L. KAUFFMAN; *Petroleum Consultant*

FOR best results in the operation of an oil field truck or, for that matter, any other type of motor vehicle, under cold-weather conditions, it is important that certain precautions be followed. Some facts worth knowing about the winter care and operation of your truck will therefore be given in the present article.

Excessive crankcase dilution is very likely to occur when using the truck in winter unless especial care be taken to avoid this condition. To prevent extreme thinning-down of the oil it is therefore necessary, first of all, to avoid excessive use of the choke. Then, after starting, give the engine time to warm up somewhat before driving.

The manufacturers of a certain type engine, which is used in many oil company trucks, have the following to say about how best to start an engine at low temperatures:

"To start an engine in cold weather, turn the engine over three compressions with the choke valve in a closed position and ignition switch off. Open choker half way, turn ignition switch on and start the engine. This procedure will eliminate extreme flooding and, if the ignition is O. K., will prove a satisfactory method of starting. As soon as possible, push the choker lever to the running or open position. Never run with the choker on; wait until the engine is properly warmed up."

One of the Oklahoma Contracting Co.'s trucks hauling pipe in Texas.

It is good practice to use a radiator cover during the winter operation of the truck. So doing allows the engine to warm up more rapidly and also to run at a higher temperature. A cold-running engine acquires dilution much more rapidly than a hot one, because all the fuel injected into the cylinders does not burn; some of it finds its way into the oil pan. Heat aids vaporization and promotes perfect combustion. A radiator cover will also reduce water formation in the crankcake. Water—if allowed to collect in the oil-circulating system—will pocket and freeze very rapidly, thereby stopping the circulation of oil.

Remember, too, that driving the truck at very low speed will tend to increase the dilution of the oil. Therefore, avoid idling for long periods or excessive slow driving.

For every gallon of gasoline burned almost a gallon of water is produced as a by-product of combustion. Most of this water passes out the exhaust in the form of vapor, but some of it finds its way into the crankcase. Any means of maintaining a warm-running engine, such as a radiator cover, will decrease the amount of water formed in the crankcase and therefore will lessen sludge formation. Crankcase ventilators also aid greatly in keeping water out of the oil reservoir. As an additional assurance that trouble in winter from water in the crankcase will be eliminated, it is good practice once or twice a week to drain a cupful of oil from the bottom of the oil pan. This should be done while the engine is warm, but after it has been allowed to stand idle for about ten minutes. If there is any water present, it will be caught in the cupful of oil withdrawn.

Oil filters are now a part of numerous makes of truck engines. In use a portion of the oil leaving the oil pump passes through the filter where any sediment is removed, the clean oil being returned to the crankcase through a hole in the side. To minimize engine wear necessitates clean oil; and to be sure that the oil is in the cleanest possible condition, check up on your oil filter at regular intervals to make sure that it is functioning properly.

The formation collecting in the combustion chamber of an internal-combustion engine is known as "carbon". This is largely the result of the natural combustion of the gasoline and oil. It is therefore to be expected that more or less carbon will collect in every engine at any season of the year (and must be cleaned out occasionally), but largely because of richer mixtures for winter driving the fact remains that carbon does tend to form more rapidly in the combustion chamber in winter than at other periods of the year. No attempt should be made to remove carbon, however, until there is evidence of the necessity for this operation.

Although carbon deposits are to be expected in any engine, they may be held to a minimum by carefully observing the following points:

1. Use nothing but the highest quality oil of the body recommended by the truck-engine manufacturer.

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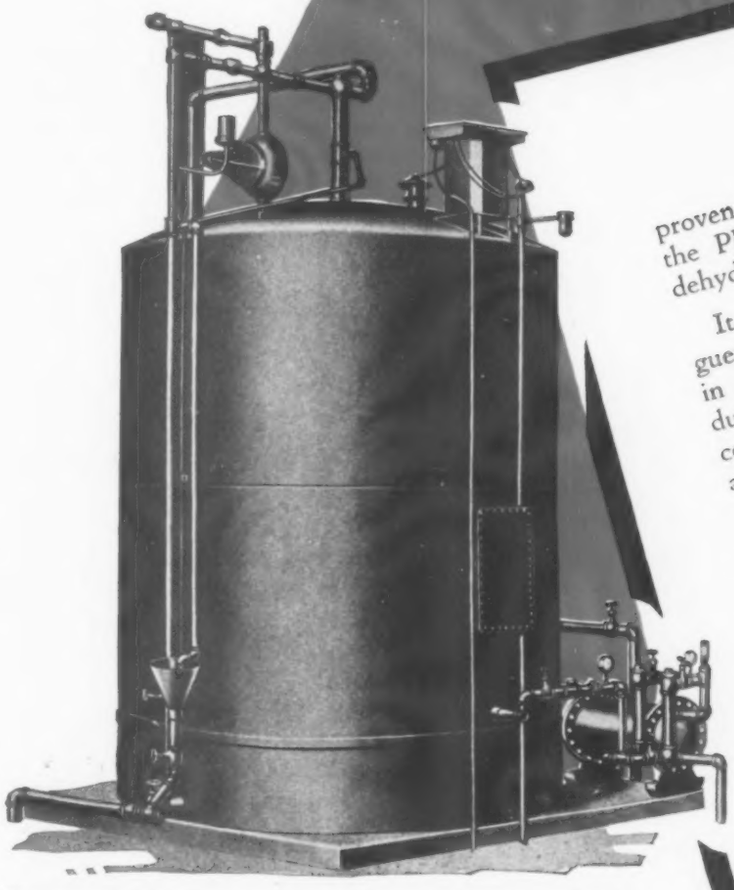

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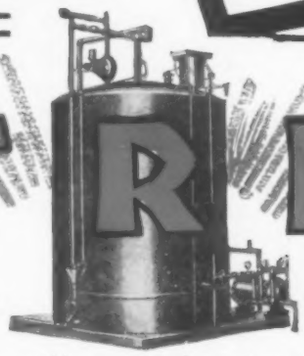

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Remember, too, that driving the truck at very low speed will tend to increase the dilution of the oil. Therefore, avoid idling for long periods or excessive slow driving.

For every gallon of gasoline burned almost a gallon of water is produced as a by-product of combustion. Most of this water passes out the exhaust in the form of vapor, but some of it finds its way into the crankcase. Any means of maintaining a warm-running engine, such as a radiator cover, will decrease the amount of water formed in the crankcase and therefore will lessen sludge formation. Crankcase ventilators also aid greatly in keeping water out of the oil reservoir. As an additional assurance that trouble in winter from water in the crankcase will be eliminated, it is good practice once or twice a week to drain a cupful of oil from the bottom of the oil pan. This should be done while the engine is warm, but after it has been allowed to stand idle for about ten minutes. If there is any water present, it will be caught in the cupful of oil withdrawn.

Oil filters are now a part of numerous makes of truck engines. In use a portion of the oil leaving the oil pump passes through the filter where any sediment is removed, the clean oil being returned to the crankcase through a hole in the side. To minimize engine wear necessitates clean oil; and to be sure that the oil is in the cleanest possible condition, check up on your oil filter at regular intervals to make sure that it is functioning properly.

The formation collecting in the combustion chamber of an internal-combustion engine is known as "carbon". This is largely the result of the natural combustion of the gasoline and oil. It is therefore to be expected that more or less carbon will collect in every engine at any season of the year (and must be cleaned out occasionally), but largely because of richer mixtures for winter driving the fact remains that carbon does tend to form more rapidly in the combustion chamber in winter than at other periods of the year. No attempt should be made to remove carbon, however, until there is evidence of the necessity for this operation.

Although carbon deposits are to be expected in any engine, they may be held to a minimum by carefully observing the following points:

1. Use nothing but the highest quality oil of the body recommended by the truck-engine manufacturer.

2. Examine the oil-level indicator daily, and keep the oil at the proper level. Do not over-fill, since over-filling causes over-oiling and excessive carbon formation.

3. Do not, to increase the oil pressure, change to an oil heavier than that recommended by the engine manufacturer. Extreme dilution of the oil, due to neglecting to change the oil at proper intervals, may cause the pressure to drop; but this condition can be corrected by draining the oil and refilling with new oil of the correct grade.

4. Avoid the indiscriminate use of heavy-bodied or low-quality lubricants, since the use of such oils is a most frequent cause of fouling spark plugs, sticking valves, excessive carbon formation and "carbon knock" or detonation.

5. Be sure that the carburetor is properly adjusted, and do not drive with the choke out any longer than is necessary. With a rich mixture, carbon forms from the incomplete combustion of both oil and gasoline, and the excess fuel dilutes the oil.

6. Keep the engine in good mechanical condition. "Missing" of the engine promotes over-oiling and excessive carbon formation, inasmuch as there is incomplete combustion and carbon forms in about the same manner as with a rich mixture. Remember, too, that compression losses lower the efficiency of combustion and the ability of the burning fuel charge to dispose of the excess oil. Therefore, keep the valves properly ground in, the tappets properly adjusted, priming cups and cylinder head gasket tight and, as aforementioned, use the correct grade of engine oil.

Cross-section view of a worm-drive on an oil field truck, showing underslung worm shaft.

To remove the carbon, drain the radiator and take off the cylinder head, being careful not to damage the gasket. The carbon can be scraped from the pistons and the top of the cylinder by cranking the engine until the pistons are at top dead center. It likewise can be scraped off the cylinder head. It is well to brush the surface thoroughly, in view of the fact that a polished combustion chamber will aid greatly in reducing carbon deposits. See that no loose carbon is left in the engine, particularly around the valve seats.

In replacing the gasket, it is good practice to spread a thin layer of grease on it. Unless the gasket is in exceptionally good condition, it is advisable to use a new one. In bolting on the cylinder head, be careful to draw it down gradually and equally so as to prevent distortion of the head or gasket.

Bear in mind, also, that the most frequent cause of leaky valves is the presence of carbon deposits on the valve seats. These deposits prevent the valves from closing properly and permit hot gases to burn over the polished faces of the valves, with consequent pitting.

An anti-freeze solution must be used in the winter operation of the truck. Before adding such a solution, however, clean the entire cooling system by draining the radiator and refilling with clean, hot water. Add a half teacupful of baking soda. Run the engine 5 minutes. Drain the radiator and flush it two or three times with clean water, running the engine for a few minutes each time. A very satisfactory anti-freeze solution is one of denatured alcohol and water.

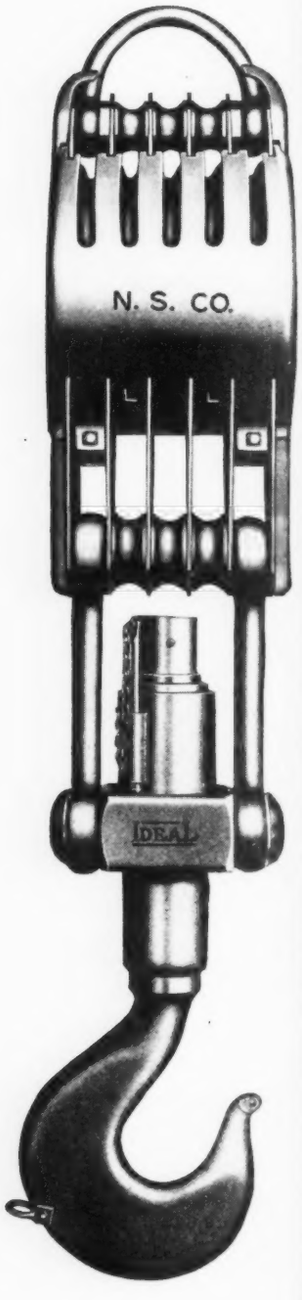
Distilled glycerine may also be used in preparing an anti-freeze mixture. The initial cost is greater than alcohol, but it has the advantage of not evaporating, so that in a season's running it is likely to prove less expensive than alcohol. Be sure to use distilled glycerine and not the ordinary commercial grade.

When mixing a glycerine-water solution it is best always to drain the water from the radiator, mix the ingredients in a separate container and fill the radiator with this mixture. This will insure thorough mixing of the solution. If alcohol is used, it will be necessary occasionally to replenish with additional mixture due to evaporation of the alcohol. In this case, fill the radiator with a mixture containing a slightly larger proportion of alcohol. If glycerine is used, only water need be added to maintain the proper level. Ethylene glycol mixed with water also makes a very satisfactory anti-freeze solution.

Richer air-gasoline mixtures are needed in winter than in summer, and this usually necessitates an adjustment of the carburetor for the winter operation of the truck. In a typical two-stage carburetor the following provision is made for summer and winter setting: An extra primary metering screw is carried in a lug over the primary air horn. This screw and another primary metering screw are interchangeable, the one with the smaller number being for summer use and the other for winter use.

In a plain-type carburetor in which the air openings and gasoline jets are fixed in size, the gasoline is automatically and accurately measured by the air flow itself, and provision is made for summer and winter setting in the accelerator well bleeder. The construction of the bleeder is such that either end may be used, the end having the larger opening being for summer or warm weather, and the end having the smaller opening being for winter or cold-weather use. The high-speed adjusting screw should be turned *out* two notches for a winter, or cold-weather adjustment, and *in* two notches for a summer or warm-weather adjustment. This adjustment should only be made when the accelerator well bleeder is changed. For winter use of the truck, see to it that the carburetor choke valve is properly adjusted.

# IDEAL




## COMBINATION
## TRAVELING BLOCK
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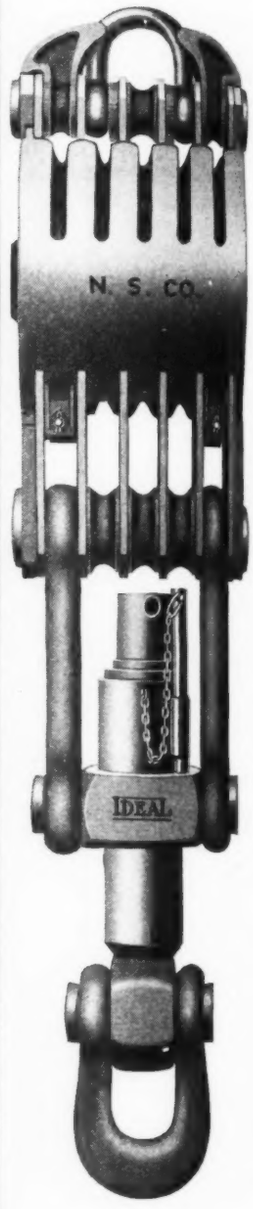



*Descriptive Bulletin*
*No. 60A*
*Sent on Request*

THE
**NATIONAL SUPPLY**
COMPANIES

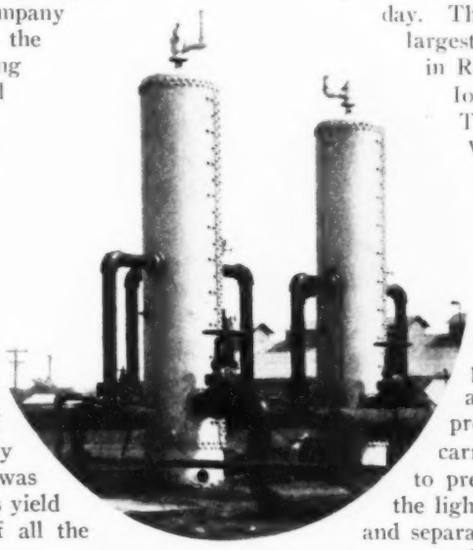
*Problems of*

# Removing Hydrogen Sulphide *from* Turner Valley Gas

*By* F. R. STALEY

THE gas treating plant operated by the Royalite Oil Company in the Turner Valley Field, Canada, was built to desulphurize the natural gas for the city of Calgary. On account of the unusual operating conditions existing in this field, many difficult problems had to be worked out before successful and uninterrupted operation resulted. The Royalite Oil Company was formed in 1921 as a subsidiary of the Imperial Oil Limited. It began drilling activities to establish a supply of natural gas for the city of Calgary.

The Turner Valley Field is the most important and interesting field in Canada. The first well in this field was drilled in 1912 near a gas seepage on Sheep Creek. The Royalite No. 4 well drilled in 1924 is, however, generally regarded as the discovery well, since it was really the first important producer in this field. Its initial daily production was 500 barrels of oil and 21,000,000 cubic feet of gas. The oil is so light that it is virtually naphtha. For about four years this well was the greatest producer in the field, and its yield was larger than the combined yield of all the others. The crude naphtha when first produced in the field was used as motor fuel without any refining, because it was so light and volatile. However, due to the heavier fractions which it contains and its sulphur content, it is necessary to refine it to make a satisfactory motor gasoline. The refining processes involved, however, are very simple. It is only necessary to distill and fractionate it, and to sweeten the distillate. It yields from 80 to 90 per cent of 400 degrees F. end point gasoline. The gasoline produced by the Royalite Oil Company is refined in the Imperial refinery in Calgary. This refinery has a capacity of 6,000 barrels per day. Its cracking equipment consists of tube and tank units. One of its products is Ethyl Gasoline.



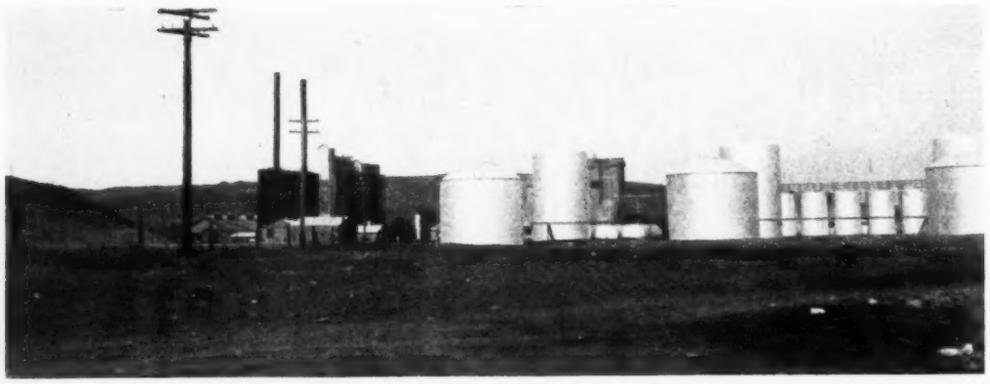
Separators in gas-treating plant.

The Imperial operates six refineries in Canada, which process more than 75,000 barrels of crude oil per day. The refinery at Sarnia is the first and largest one. The other refineries are located in Regina, Dartmouth, Montreal East and Ioco in the Canadian Rockies.

The natural gas produced in Turner Valley contains as much as 650 grains of sulphur per 100 cubic feet. Very often the gas enters the plant at a temperature as low as minus 30 degrees F. The low temperature is produced by the refrigerating effect caused by the high rock pressure of the wells and the very light naphtha produced with the gas, which produces a great temperature reduction when the pressure is reduced. It is necessary to carry a high back pressure on the wells to prevent freezing up. The expansion of the light constituents cool the gathering lines and separators so much that they are frequently coated with many inches of ice or frost. The plant is equipped with steam heat exchangers to warm both the gas and the treating solution to prevent freezing; however, it is necessary only in the winter weather, when peak loads occur, to use the heaters.

The treating plant has a capacity of 65,000,000 cubic feet of gas per day. The sulphur content of the treated gas is reduced from over 600 grains to less than 10 grains per 100 cubic feet. The reduction takes place in two stages.

Refinery of the Imperial Oil Co. at Calgary, Canada.



Gasoline storage tanks at Calgary.

In the first stage it is reduced to 200 grains, and in the second, from 200 to about 5 grains. This is well below the allowable limit of 30 grains maximum. The plant contains 16 gas absorbers, or scrubbers, and four actifiers for reactivating the treating solution. The absorbers are 60 feet high and three feet in diameter. The actifiers are 54 feet high and 15 feet in diameter.

The gas is first run through separators in the field, and then to the plant through 10-inch lines under about 300 to 350 pounds pressure. At the plant the gas is first run through separators, and the separated gasoline is run to the storage tanks, from which it is pumped to the Imperial Refinery in Calgary. Nine pounds pressure is carried on these tanks. The pipe line to the Calgary refinery is 32 miles long and four inches in diameter. A 700-pound working pressure is used. It transports about 5,000 barrels of crude naphtha per day.

### *Treating Process*

The process of desulphurizing the gas consists in scrubbing it with a solution of soda ash, and then reactivating the solution with air, and using it again in a continuous process. A solution containing two per cent to three per cent of soda ash is charged to the system, and after use it contains some sodium bicarbonate and sodium hydrogen sulphide, with a reduction in the carbonate content.

In the actifiers the spent solution is blown with air, which carries off the hydrogen sulphide into the atmosphere. There is also a slight reduction in the carbonate content, and some of the sodium hydrogen sulphide is oxidized to sodium thiosulphate, which gradually accumulates in the solution. The loss is made up by small additions of fresh soda ash at intervals.

The condition of the solution is controlled by the alkalinity, and the sulphur content of the gas is run with a Tutweiler burette.

The gas enters the scrubbers at the bottom and passes out at the top. The sodium carbonate solution is pumped into the top and flows down to the bottom over grids. In the actifiers the spent solution is pumped into the top of the towers and flows down over grids, and air from the blowers enters the bottom of the actifiers and carries the hydrogen sulphide up the stack into the atmosphere.

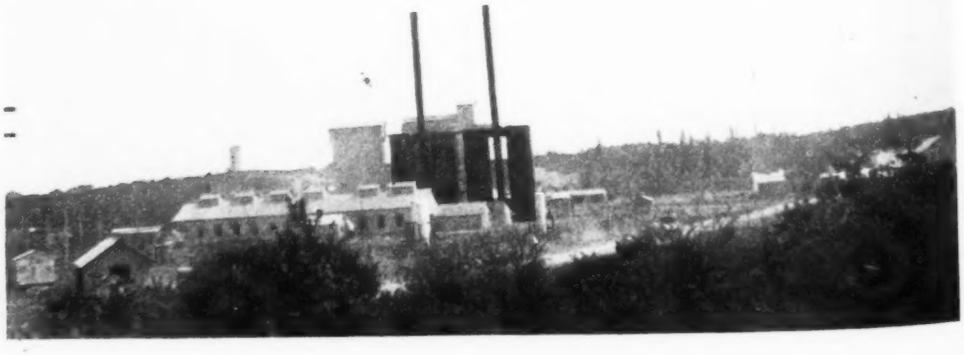
The treated gas is freed from the foul odor and corrosion and is satisfactory for industrial or domestic consumption.

S. G. Coultis is superintendent of the plant, and F. C. Tempest is the operating foreman.

### *Machine Shop*

The Royalite Oil Company maintains a modern machine shop at the plant to take care of virtually any field or plant repair job that might be necessary. The shop is under the supervision of R. Wismer, master mechanic, and handles the mechanical work for the gas plant, production and pipe line departments.

The shop, so well equipped with the most modern machinery, is rated as one of the best of its kind in the province of Alberta. Such a shop was necessary because the field work is so isolated from any other repair shop that is equipped to handle the type of work.



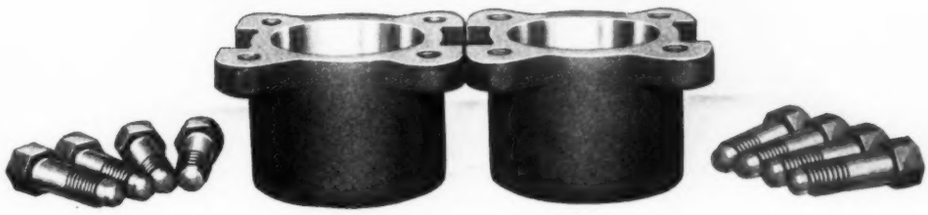
Gas-treating plant at Calgary.

# Closer Tube Spacing

## *with this New Key Return Bend*

Key Condenser Fitting. Note difference in tube spacing between this and sectional illustration.

Showing parts of Condenser Fitting.



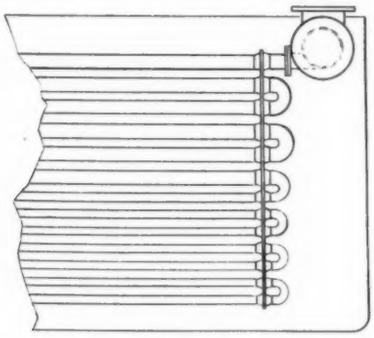
THIS new Key Return Bend is adapted for every type of assembly desired in Condenser, Tar Cooler and Heater Coil service.

The close assembly permitted with these fittings allows approximately 25 per cent more tubing to be used in a given amount of space than is possible with the ordinary flanged construction. The need of a supporting structure in the tank is also obviated with the use of these fittings.

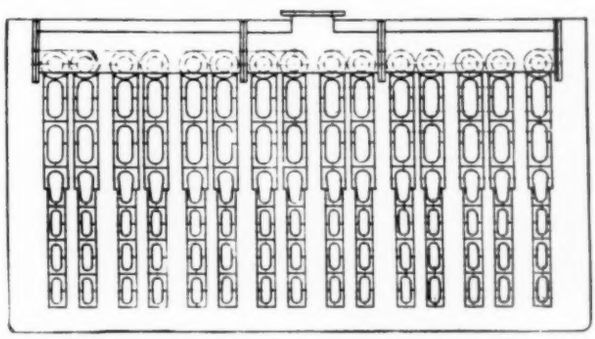
Further advantage lies in the easy replacement feature. Replacement of any one tube is possible without disturbing other parts of the assembly. The U-Bend, which is the only part subject to excessive wear, can be replaced at nominal cost.

These fittings can be supplied for all tube centers and tube sizes, and have a high factor of safety for all working pressures required on Condenser Coils. They are regularly made with forged steel tube ends and cast steel U-Bends, but they can also be made of cast iron, cast iron chrome nickel alloy, or any other metal on customer's specifications.

For complete information on these Fittings, write the nearest office listed below.



Side elevation of condenser assembly.



End elevation, showing close tube assembly. Note reduction of diameters, possible with this fitting.

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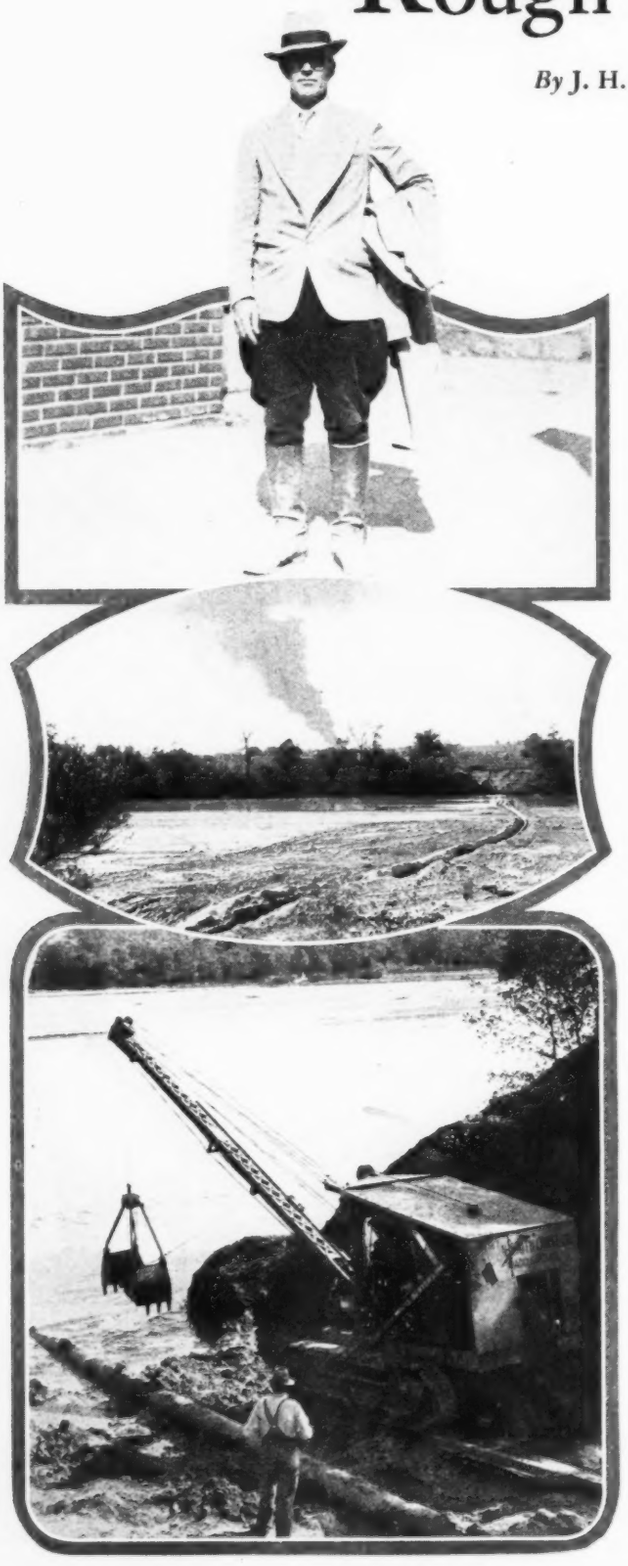
# Sinclair's New Pipe Line Traverses Rough Country

*By* J. H. DAMERON



Top to bottom—J. C. Truman of Truman-Smith Construction Co., Eldorado, Kansas.—Single line crossing Arkansas river. Note ample slack in line.—Clam-shell cutting trench for river crossing near shore of Arkansas river.

PUSHING through the Osage hills of Oklahoma, famed because of their rocky and rugged character, with a 12-inch oil carrier for the Sinclair Pipe Line Company, the Truman-Smith Construction Company is literally blasting its way ahead of schedule on its 74-mile section of the line. Because of the roughness of the country, with its sharp, stony hills, the contractors are forced to use tons of dynamite and some of the heaviest and most modern construction equipment to build through the colorful country, rich in Indian lore and oil history as well as notorious at one time as a rendezvous for bandit gangs.

The new oil carrier will be approximately 146 miles in length. Leaving the Oklahoma City field, it will go almost due east to a point near McCloud, where it will swing north and follow a northeasterly direction to Tyro, in Kansas, where the 12-inch line terminates. A short 8-inch lateral will be built east from Tyro to the Sinclair Company's Coffeyville, Kansas, refinery. No announcement has been made relative to the initial number and capacity of stations, but it is reported the stations to be built will be Diesel engine powered driving reciprocating pumps.

No extremely difficult construction problems are found along the line until it approaches the Osage hills and crosses that stretch of country. After leaving the Osage hills the line traverses considerable country offering construction difficulties, but not of the same caliber as those found in the Osage.

Brush gangs were started from the south end of the section around the first of October, and a short while later two complete construction gangs were moved in. When the line is scheduled for completion (the latter part of November), four gangs will be in the field.

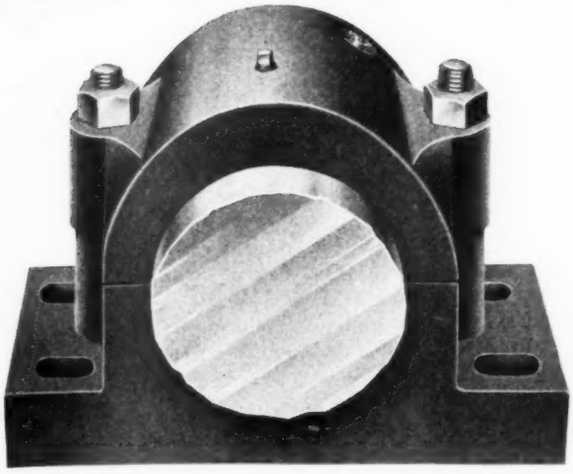
Both of the main gangs have two ditchers, six tractors, a heavy-duty pull shovel, a combination shovel and clam bucket machine, backfiller and bulldozer, in addition to welding equipment and trucks. In all, something more than $400,000 worth of construction machinery will be used to string the north section of the line.

The pipe is 12-inch line pipe made in 40-foot joints and given a priming coat at the mills. Instead of snaking it up and down the sides of the rocky and steep hills, the stringing gangs unload a sufficient number of joints on top of the hill to reach to the bottom. It is then welded in five-joint sections and moved down when the tie-in gang reaches it.

In the dirt country the ditchers move along with speed, but find the going rough in the broken country. In some sections of this country ditchers skim off the dirt overlaying a rock stratum and move along. Sometimes the power shovels can rip out the rock and dig out the required 36-inch trench. When this is not done the blasting gang shatters the rock for the following heavy machinery or the ditch gangs following along behind.

An unusual percentage of the right-of-way through the Osage has to be blasted. In some instances, as many as 200 shots are required to shatter a section of rock. The shooting gang is comprised of three men who have a truck on which

# GREASE SEALED



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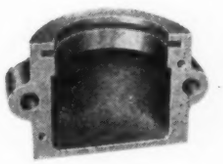

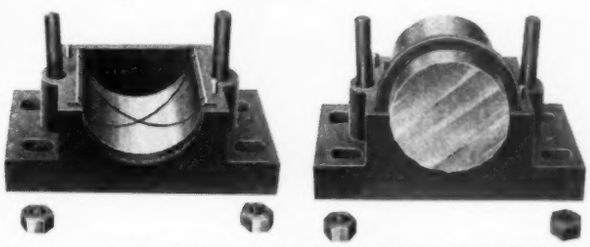

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is mounted an air compressor. With this, one of the crew operates the air drill to drill the shot holes. Another cares for the blasting material and prepares the shots, while the driver operates the truck and aids in igniting the shots.

After the blasting, the power shovel follows along, ripping out the loose rock and cleaning the trench. This phase of the work slows up progress considerably, and to hold to schedule, the rock gangs are pressed into service in ditching. Despite the difficult construction problems, around a mile of pipe is being laid daily through the Osage.

Moving welding equipment over the line is likewise a perilous task, and frequently it is necessary to lock the wheels on the wagons and worm them down steep hills while crew members help hold them upright with lines lashed to the equipment.

The firing line on each gang has three generators with four welders working from each unit. Specifications call for a weld one quarter of an inch wide and three sixteenths of an inch high. On an average, it requires 40 minutes to make a weld around the pipe when everything is in readiness. When moving and setting-up time is counted, around 20 minutes additional is added to the average weld.

The firing line welds the pipe into five-joint sections. After the sections are completed, they are swabbed to knock off the icicles and remove the dirt, and then the ends are covered until the laying gang reaches them.

The swabbing crew works just a short distance ahead of the laying gang. A piece of boiler plate, cut to fit snugly inside the pipe, is fashioned, and a sucker rod welded to the center of it. Additional lengths of rods are attached so it can be pulled through a section of the pipe. A team is used to pull the swab through the pipe, and as it travels through it shoves the dirt ahead and knocks off any icicles inside the pipe caused by welding. Such a method of cleaning the line has proven quite satisfactory and cleans the line of most of the dirt as well as removing the obstruction to flow caused by the icicles.

Following close behind the swabbing gang, the tie-in gang with its tractors moves along with good speed. Two tractors handle the five-joint sections and maneuver them into line so they may be tack-welded and later completely welded.

Numerous overbends, sags and side bends are required in the broken country, and the big tractors are used to make all of the bends. The sags are made by raising the two ends of the pipe with tractors while the third tractor holds it down. For a slight bend, frequently one tractor is used to hold down the pipe and pull up on one end. The overbends are made by reversing the method used to make a sag, and the side bends are made by one tractor pulling while another holds the center and the third has a line attached to the free end of the section.

As the line is tied in, the paint gang follows with a tractor to raise the pipe as the paint is spread by workmen using a canvas sling. A cold coating is being applied to protect the metal from corrosion.

All of the backfilling is done with machinery.

Crossing the Arkansas was the longest river crossing to be made. The river was approached at low stage, and the actual water crossing was a relatively short distance. Pipe was strung and welded on the sand to the water's edge on the low side of the river, and the crossing section was made up on the opposite shore and pulled across with tractors using a double line and single block.

**Top to bottom—R. B. Billfaldt, of Truman-Smith Construction Co., and H. C. Gilbert, right-of-way inspector for Sinclair Pipe Line Co.—Applying coating of protective paint in a difficult place.—Shattered rock after a 50-stick blast.—Ditcher skimming dirt off of rock strata approximately 14 inches under soil.**

# Methods *of* Handling Pipe Line Field Runs

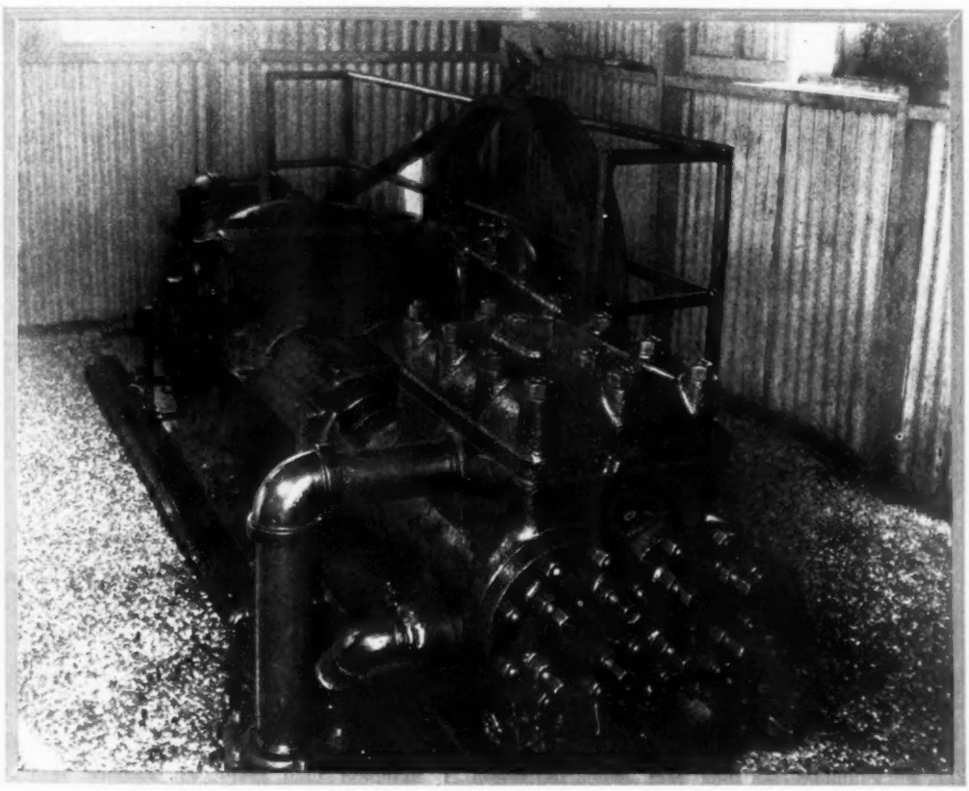
*By* J. H. TUBBS, *Ass't to the Manager, Pipe Line Dept., Deep Rock Oil Co.*

THIS article will discuss briefly the methods and equipment we use in handling pipe line field runs to stations by using electricity as power to drive field pumps.

We have found that by proper arrangements, production from small leases can be moved very economically with an electric power pump. Leases producing as little as four to five thousand barrels per month can be handled at a cost that will not exceed two or three dollars per thousand barrels moved. Leases producing larger amounts, of course, make a much better showing and in many cases can be moved for as low as one and one-half to two dollars per thousand barrels.

In order to take advantage of these savings we use the following equipment:

1. Small duplex interchangeable liner type power pumps.
2. Squirrel cage motors as small in H. P. as seems feasible for job.
3. Time clocks to shut down motors.
4. Pressure switches to shut down motors.
5. Complete automatic equipment for starting and stopping motors.



Motor-driven field pump in one of the Deep Rock Oil Company's stations.

We prefer the liner type pump on account of being able to change the rate of discharge as the production on the lease changes, at a very small cost. By changing the rate of discharge we are able to move the oil most economically, electrically speaking, as we build up as low pressure as possible, which with volume of oil moved, more or less governs both electric demand and energy charges.

The late model liner type pumps are being built with bearings and gears enclosed in a case to be filled with oil which helps materially in maintenance, as dangers of lack of lubrication are reduced to a minimum. We also mount both the pump and motor on channel iron and drive through Texrope. This arrangement makes a very compact unit and can be moved with very little trouble and expense.

By using small size motors we are given a low demand charge by the power company where the demand charge is based on a flat charge of two dollars per connected H. P. as is usual on locations where we are unable to combine a number of motors and obtain a demand figure based on the actual demand recorded on the demand meter. Also by using small motors they are more fully loaded and should be more efficient than where pumps are overpowered. A considerable saving in motor investment is also obtained by following this plan. We find that in most cases the range is from five to fifteen H. P. We use time clocks to stop motors and pumps in a number of places. The oil is turned on the line by the gaugers who also figure the number of hours necessary for the pump to run in order to move the oil and set the clock to stop motor at time oil should be out. By using these clocks it is unnecessary to make arrangements with the producer to shut down the pump.

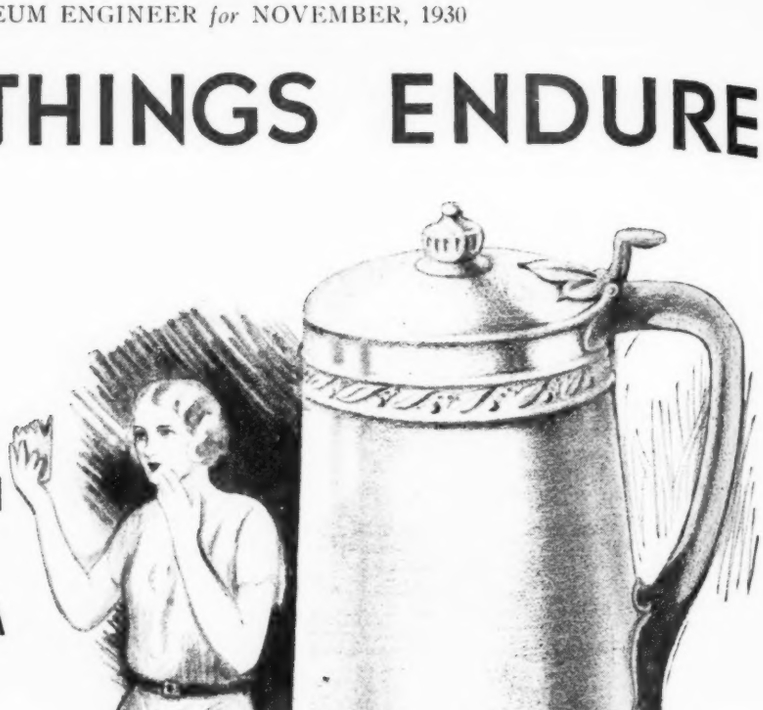
Where pumping is uniform and the pressure not liable to change we use a pressure switch to stop the motor on both a pressure increase or decrease. This instrument is tied into the discharge stream from pump and will stop the motor when all oil is pumped out due to a drop in line pressure and also stop motor for the same reason if the discharge line should become broken or blocked.

At the present time we are using two completely automatic pickup or booster stations where the oil flows by gravity and is pumped into a two-thousand-barrel tank in one case and a five-thousand-barrel tank in the other. The pickup stations both handle all oil from two districts and have been in use during the past twenty months, having proven most satisfactory. The equipment in use at these stations consists of the following:

1. Duplex interchangeable liner type power pump, driven

# FLEXIBLE THINGS ENDURE

## GLASS WILL BE BROKEN WHILE PEWTER BECOMES AN HEIRLOOM



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**Not because of their rubber composition, which is obviously very flexible but because of the way it is handled to produce an even more flexible result, are the cups on the Guiberson Swab outstanding for long wear and better work.**

**Guiberson Swab cups resemble rubber bowls encased in baskets of wires. In lifting a column of fluid, when wrinkles or protrusions are encountered in the casing, the wires steer the cup rims safely past, while the rims still maintain a seal with the protrusion, avoiding any loss of the load. The weight of the column presses the cup rims firmly against the casing walls, making a perfect seal. Pressure from below collapses the cups, allowing far speedier passage into the hole. Users endorse this advanced principle by employing Guiberson Swabs to do most of the world's swabbing today.**

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through Texrope drive by "across-the-line" (double squirrel cage) motor.

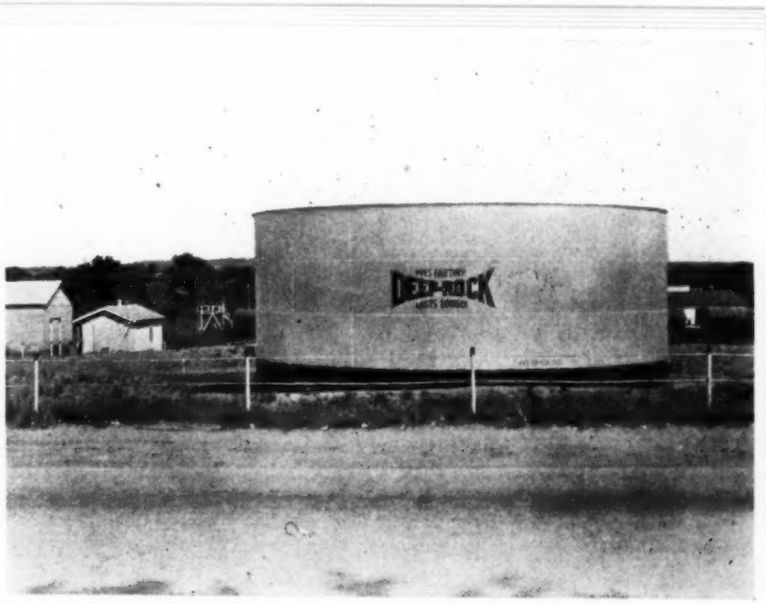
2. Station "A," one five-thousand-barrel tank. Station "B," one two-thousand-barrel tank.

3. Liquid level control to start and stop motor.

4. Relay protective panel.

5. Indicating and recording pressure gauges.

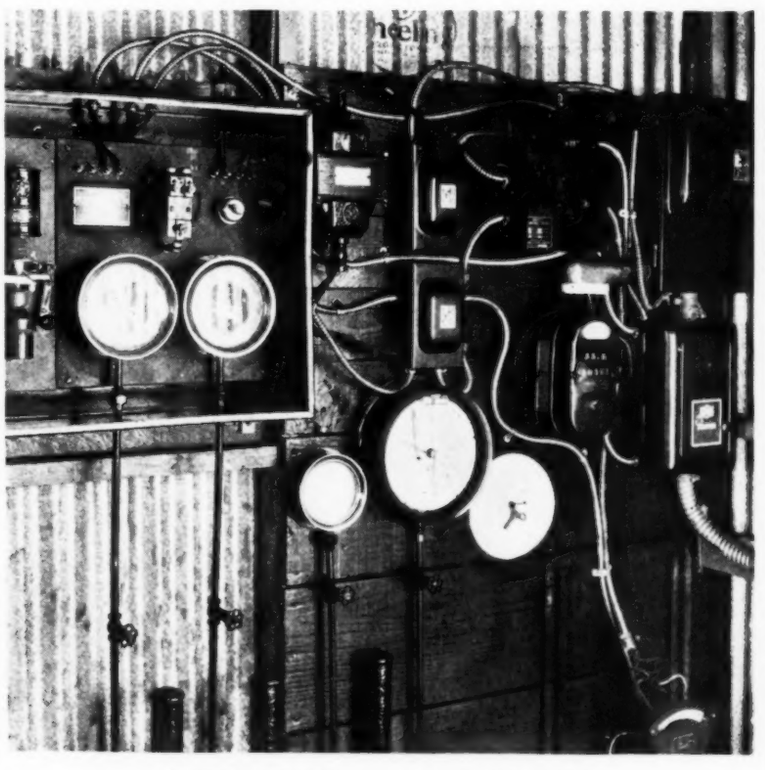
The cycle of operation of these stations is as follows: The oil is turned on line by district gaugers and is pumped or flows by gravity into the tank at station through one or more lines. When the oil level reaches a pre-determined point an electrical contact is made through the medium of the liquid level control which starts the motor and pump. The pump continues pumping until the oil level reaches the point at which it is desired to stop pump. At this point it forms another electrical contact which stops the motor and pump.



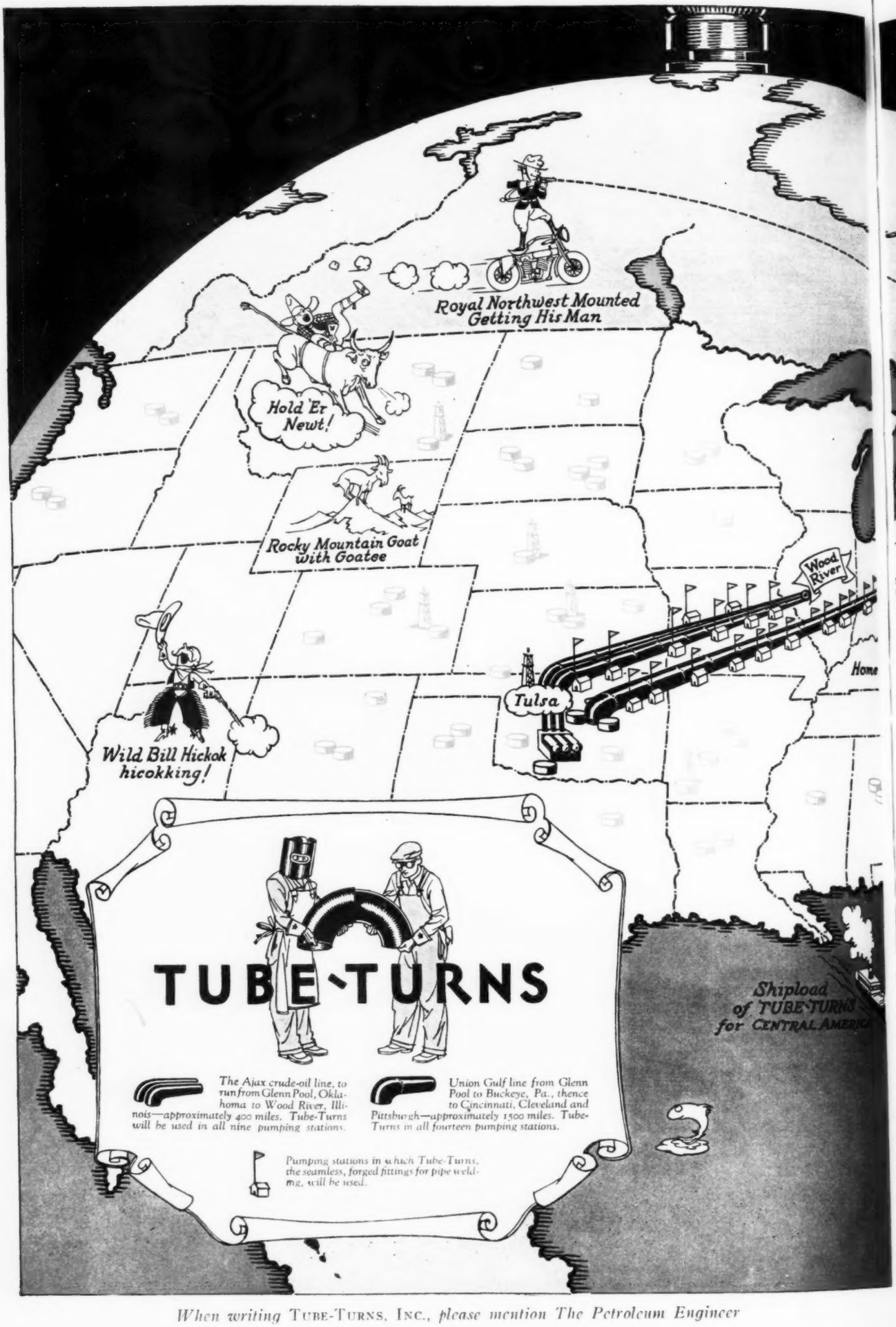

**Oil tank serving one of the automatic stations, showing comparative size of station (small building) on left of tank and working tank.**

The relay protective panel is tied into the pump discharge and serves as protection against the station pumping into a broken or blocked line and operates as follows: When the motor is started the pressure gauge on right indicates the pressure and when the needle reaches the top contact which is set at a figure slightly higher than operating pressure, the relay above same is closed and energizes the pressure gauge on the left. The top contact on this gauge must be set at a pre-determined pressure (higher than operating pressure), and when the needle touches this contact, indicating a closed valve ahead of the station or touches the bottom contact which is set at ten to twenty-five pounds less than normal working pressure, indicating a broken line, the relay at the left, then is opened, stopping the motor. There is a mercury container in connection with this relay. By using mercury the action of the relay can be retarded so that the relay will not open for several minutes after the needle has touched the bottom or top contact. This time element can be changed by using more or less mercury. After this relay has opened, it can be reset by a lever at the right of same, and after this is done the panel is again ready for operation. The object of this mercury time relay fixture is to take care of pressure surges when pump first starts.

In conclusion, our company is operating a number of pumps in the manner described herein, which move in excess of two hundred thousand barrels per month at a cost of around two dollars and twenty-five cents per thousand barrels moved. The pressure range is from fifty to six hundred and fifty pounds and individual lease volume from four to seventy-five thousand barrels per month each. Average cost of power, including both demand and energy charges, amounted to around 0.225 cents per KWH.



**Automatic control instruments in one of the stations.**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Rocky Mountain Goat with Goatee
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Tulsa
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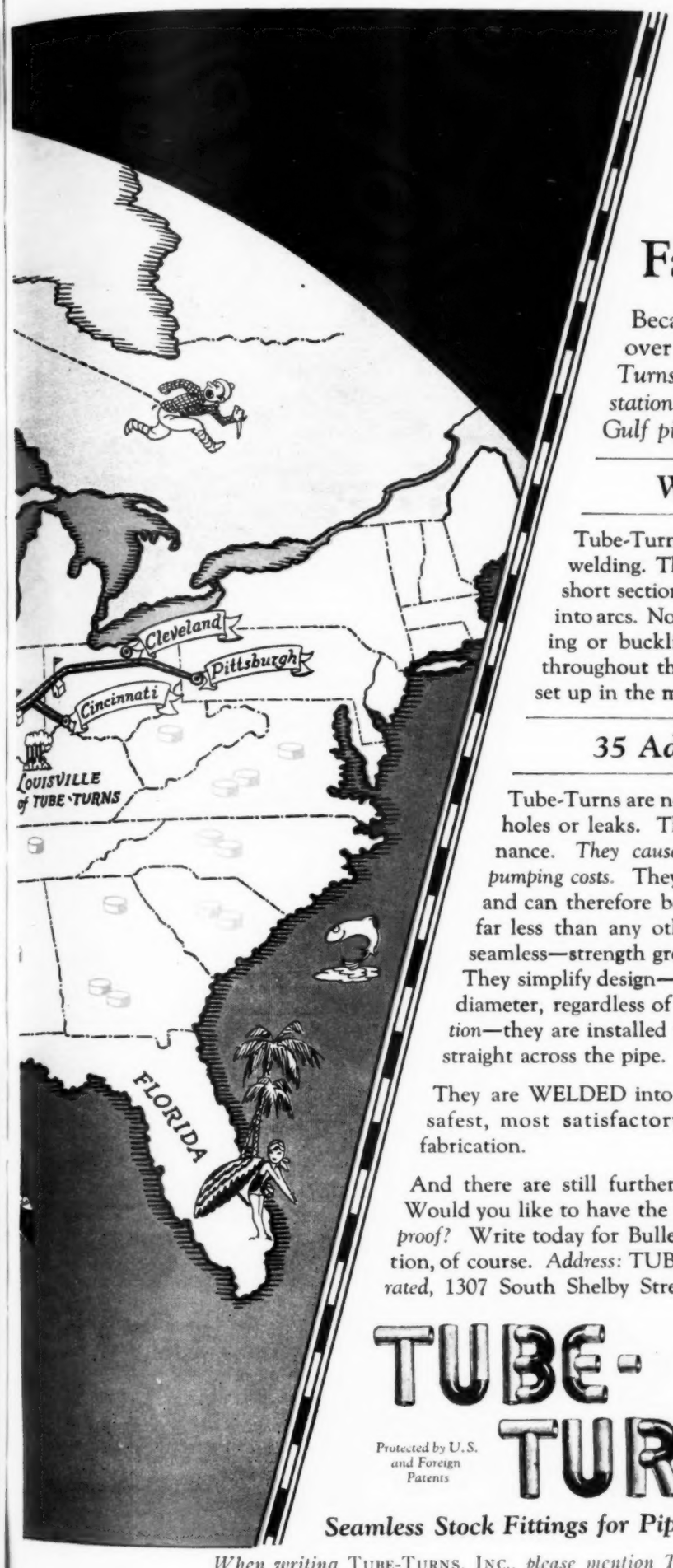
The Ajax crude-oil line, to run from Glenn Pool, Oklahoma to Wood River, Illinois—approximately 400 miles. Tube-Turns will be used in all nine pumping stations.
Union Gulf line from Glenn Pool to Buckeye, Pa., thence to Cincinnati, Cleveland and Pittsburgh—approximately 1500 miles. Tube-Turns in all fourteen pumping stations.
Pumping stations in which Tube-Turns, the seamless, forged fittings for pipe welding, will be used.
Shipload of TUBE-TURNS for CENTRAL AMERICA

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Tube-Turns are seamless, stock fittings for pipe welding. They are lighter, *stronger*—they are simply short sections of seamless steel tubing, FORGED into arcs. No thinning of outside walls, no thickening or buckling of inside walls—full pipe size throughout the turn. No stresses or strains are set up in the metal by manufacture.

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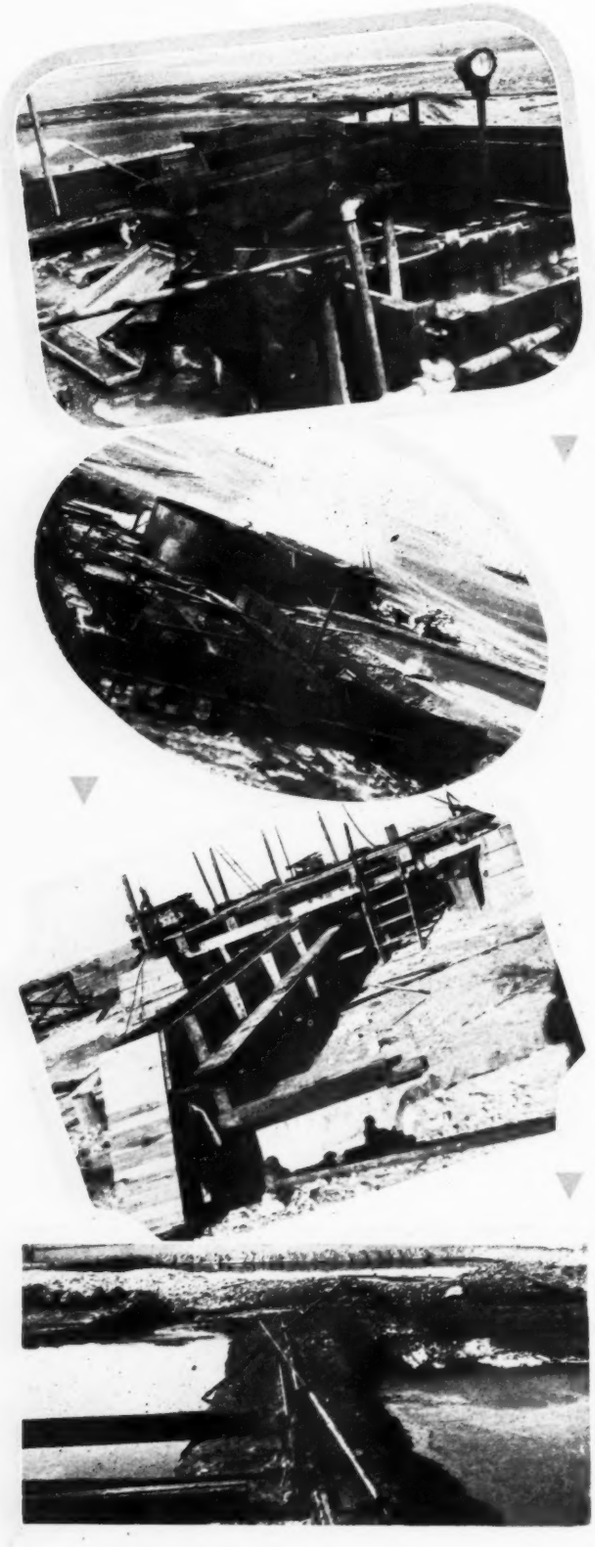
## *Hobbs Conditions Necessitate*

# Elaborate System *of* Handling Mud

*By* ROBERT S. CHRISTIE, *Petroleum Engineer, Amerada Petroleum Corp., Hobbs, N. M.*



SLUSH pits and rotary mud have been an important item of the drilling costs in the Hobbs field, Lea County, New Mexico. Hard caliche formation on the surface makes the digging of slush pits expensive, and high gas pressures at comparatively shallow depths make it necessary to use imported rotary muds. Considerable experimenting has been done to determine a proper drilling fluid so that the number of blowouts may be reduced.

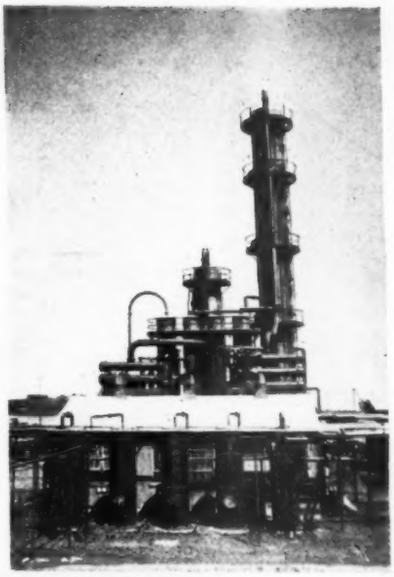
In order to obtain a better idea of the troubles encountered in drilling, it is necessary to know something of the subsurface conditions. The following is a brief description of the formation penetrated in the northern part of the field, where the mud problem is the most difficult: From the surface to approximately 200 feet is caliche and sand. From the base of the caliche and sand to approximately 1500 feet is the red beds section, which is the only formation drilled containing sufficient clayey material to make mud. Below the red beds there is 150 feet of anhydrite, below which is the Polyhalite or salt series, which continue to about 2500 feet. The next 150 feet is predominantly anhydrite with some salt. From 2650 feet to 2750 feet is a sandy section which is commonly referred to as the Queens Section. From 2750 feet to 3600 feet the formation is predominantly anhydrite with streaks of sand and sandy shale. The anhydrite is gradually replaced by lime to approximately 3875 feet, where another sandy section is encountered. There is approximately 80 feet of this lime and sand section, at the base of which is encountered the principal oil-producing formation known as the White or Crystalline Lime.

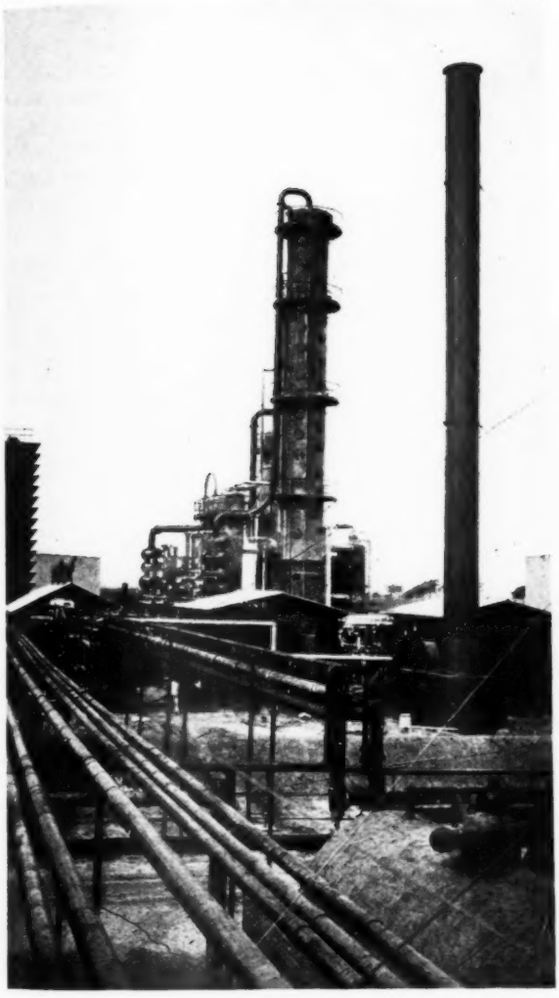
The following casing program is more or less standard throughout the field: The surface pipe, which is usually 12½-inch, is set in the top of the red beds at about 225 feet. The 9⅝-inch casing is usually set at about 2750 feet. The oil string, usually 7-inch O. D., is set just above the top of the Crystalline Lime. Three-inch tubing is run in all wells in the north part of the field before they are put on production.

The first gas, found at approximately 2800 feet, just below the 9⅝-inch casing, is usually of small volume, but quite often has sufficient pressure to blow the water out of the hole. The second gas horizon, which usually carries oil also, is encountered at approximately 3200 feet. Generally there is gas in a third sand at about 3700 feet. The main pay is in the Crystalline Lime, penetration varying from 150 to 200 feet. If water will not hold down the gas in the 2800-foot zone, it becomes necessary to use a heavy drilling fluid. With a subsequent increase of gas and oil at 3200 feet, and again at 3700 feet, the danger of blowing out becomes still more serious. In order to prevent blowouts, mud made heavy by use of various minerals is used. Unless the mud has a relatively low viscosity it will easily

**Top to bottom — Automatic mud recorder and vibrating screen hook-up used by Amerada Petroleum Corporation. — Circulating system and reserve tanks on an Amerada well.—Flume to cuttings pit on Amerada well.—View of circulating and reserve pits on a Humble lease.**

# *the* NEW?





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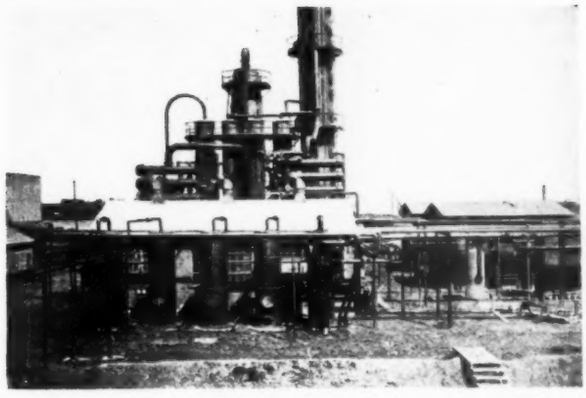

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be cut by the gas and oil, and in a short time, become too light to hold the gas pressure. Fresh mud would then have to be mixed and the light gas-cut mud disposed of by getting into the large and expensive reserve or rejection pits. No heavy mud is required until after the 9⅝-inch is set, as there is no gas nor cavey formation. Some wells structurally low have not had enough gas to require mud. These have been completed in much less time than adjacent wells which had to use heavy mud.

The first pits in the Hobbs field were constructed in the usual manner, consisting of a suction pit, a circulating pit and a cuttings pit, into which drilling mud flowed from the discharge to the circulating pit, then to the suction pit to be again picked up by the mud pumps. Cuttings and gas-cut mud were jetted from the circulating pit into the cuttings pit. In drilling through the gas area where expensive mud had to be used this circulating system was unsatisfactory, as a large part of the mud would settle with the cuttings and adhere to the sides of the pits, eventually having to be jetted into the cuttings pit. With this system approximately one-fifth of the mud would be in circulation. Jets were usually placed around the pits to keep the mud mixed, but this also reduced the efficiency of the mud, as the cuttings also were kept in circulation by this agitation. On the present completed wells, where it was necessary to use a heavy drilling fluid, costs varied from $5000.00 to a maximum of approximately $16,000.00 per well, and most of the mud was left in the pits. Much of this expense can be eliminated by constructing a different type pit which permits a more careful handling of the expensive rotary mud.

Top to bottom—Suction pit of an Amerada Petroleum Corporation well.—Mud-mixing box used at the well.—Slush ponds on Humble lease before starting well, showing surface formation.—Views showing vibrating screen set-up on a drilling well of the Amerada Petroleum Corporation.

The essential properties of good rotary drilling fluid in the Hobbs field are weight, low viscosity, resistivity to gas and oil cutting and ability to stay in suspension. The mud must weigh as much as 13 pounds per gallon to hold the high pressure. The viscosity should be low so the gas will break through and not build up to the formation pressure. Much better drilling time can be made with a low viscosity mud. It is necessary that the weighting mineral stay in suspension and not settle while coming out and going in the hole with the drill pipe. It should have the property of releasing occluded gas bubbles and oil globules quickly or the mud will become light and fluffy. The admixtures most commonly used are barites with approximately two per cent by weight of some colloidal clay; also, barites with various percentages of native clay; and other commercial weight mixtures. All of these mixtures have proven quite successful. The specific gravities of the mineral range from 2.5 for clays to 4.25 for the finely ground, and are capable of producing a rotary mud weighing from 12 to 17 pounds per gallon.

The first device constructed with the idea of saving mud was the aerating tower. The tower was set up near the circulating pit, where an auxiliary pump pumped the mud from the circulating pit over the tower, from which it ran into the suction pit to be picked up again by the mud pumps. This device liberated some of the gas, but, when operating, would clog up. Another type used consisted of a joint of perforated casing, either connected directly to the discharge line or to an auxiliary pump. The pump pressure sprayed the fluid through the perforations out over the pit. Realizing the advantage of a long travel over settling in liberating the gas, the next improvement was the use of long wooden circulating flumes, which reduced both the number and size of the pits required. By using the flume practically all the mud is kept in circulation, and the velocity is enough that the cuttings will settle in the flume. The specific gravity of the finely-ground minerals used in the mud being more than that of the cuttings, they would settle out to some extent with the cuttings. In removing the cuttings from the flume much of the expensive minerals would be removed with them, so it was desirable to have some method of re-

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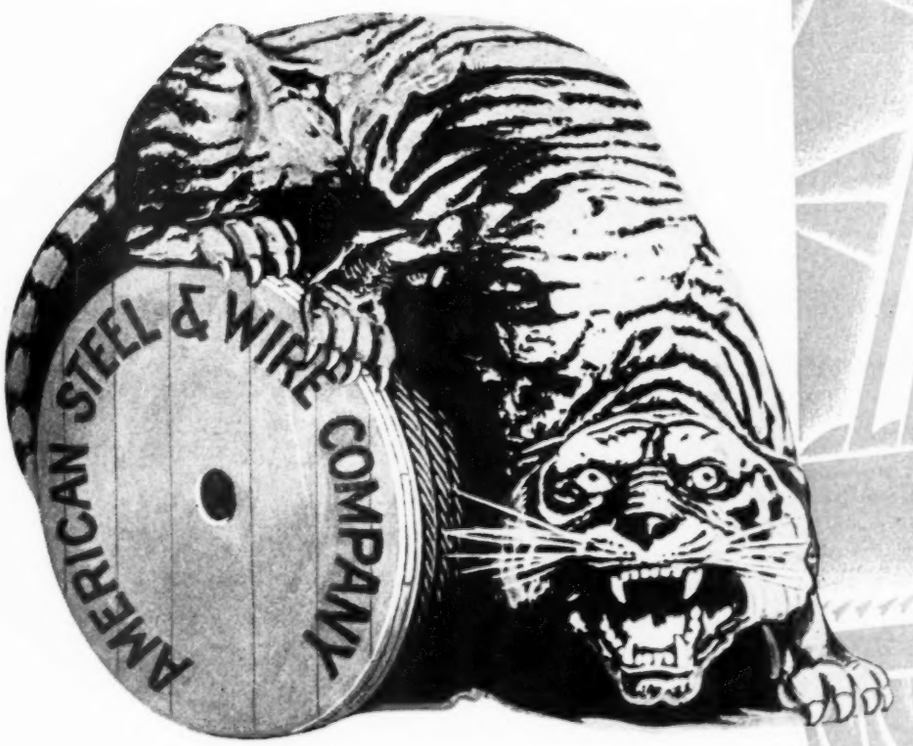

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moving the cuttings without removing the heavy mud material. This condition led the Amerada Petroleum Corporation to adopt the use of vibrating screens.

The vibrating screen has proved valuable not only for the removal of cuttings and reducing pump repair costs, but has cut down the cost of pits, requires less mud, assists in liberating suspended gas and oil, and keeps the mud in smooth, consistent condition. The most satisfactory arrangement so far is to have the screen set up at the well discharge and remove the cuttings first. The screened mud then runs directly to the suction pit.

Screening the mud seems to facilitate the escape of gas and the separation of oil from the mud. There seems to be no increase in the weight of the mud immediately after passing through the screen, but after leaving the screen the gas and oil apparently work out of the mud. On one location where the oil and gas cut the mud very badly it was noticed that gas vapors were continually rising from the screen cloth and free oil appeared on the mud after passing through the screen. By using the screen the weight of the mud remains more nearly constant for a longer period of time than when it is not used. The screen has also proved valuable in cleaning up and salvaging mud from old slush pits where thousands of dollars' worth of mud had been discarded. By using vibrating screens the number of pits and the amount of expensive mud used are both reduced to a minimum and practically all the mud not left in the hole can be used again.

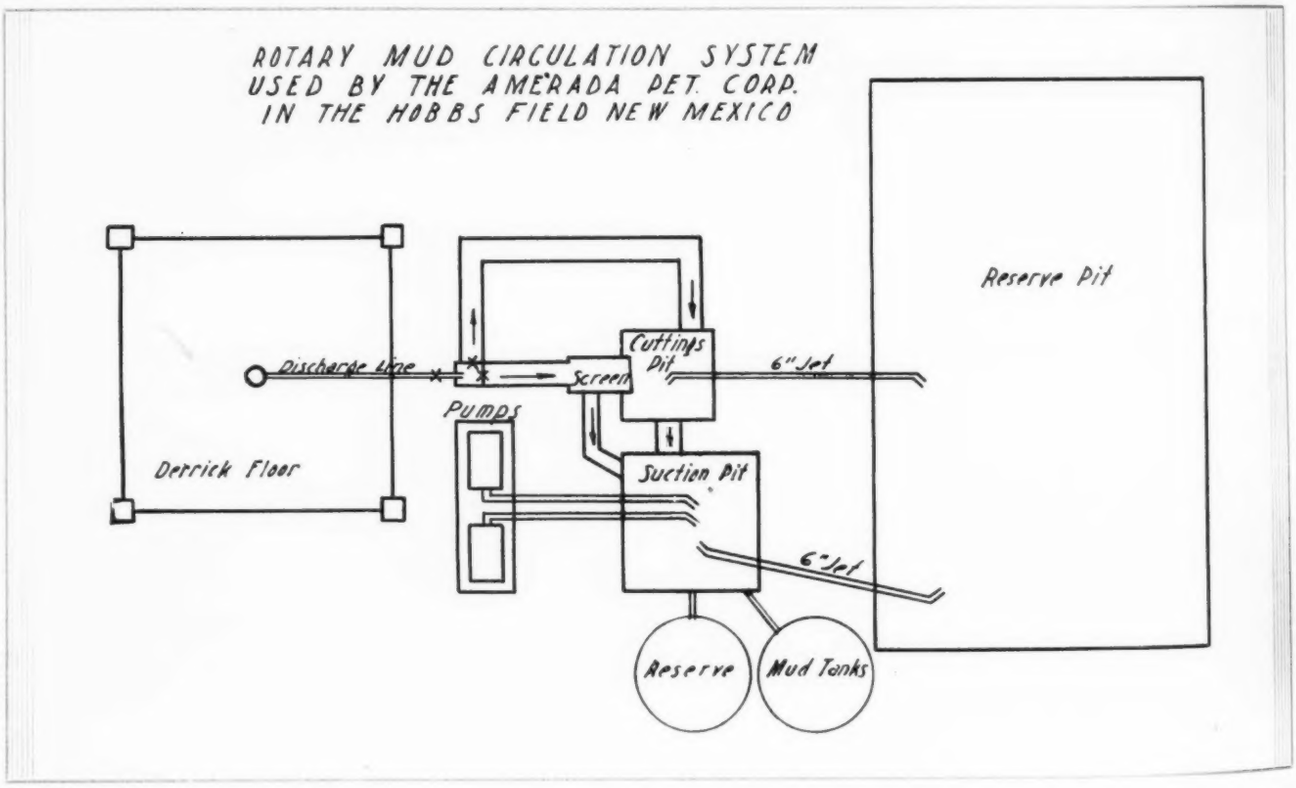
The standard method used by the Amerada Petroleum Corporation is illustrated by the accompanying diagram, which shows the construction and location of flumes and screen, with necessary pits. When the screen is not being used the drilling fluid is run through the by-pass flume into the cuttings pit. While this pit is small, it is sufficiently large to slow the fluid enough to permit the cuttings to drop out as long as heavy mud is not being used. When the screen is in use the mud runs through a flume to the screen, which vibrates at the rate of about 1800 R. P. M. Different mesh screen cloths are used, depending on the viscosity of the mud, kind of cuttings, angle of screen, etc. A 40-mesh screen set at a 15-degree angle seems to work very satisfactorily under most conditions. The screened mud runs into the suction pits and the cuttings drop into the cuttings pit, from where they are jetted to the rejection pit.

If in the course of drilling the mud becomes gas-cut and fresh material has to be added to maintain the proper weight, the volume of mud is increased to such an extent that the suction pit will not hold it, and the additional supply is pumped out of the suction pit into a reserve tank set up for that purpose. At the completion of the well this reserve along with the mud used for circulation is rescreened and cleaned and pumped to a new location. While there is very little difference in the first cost of this installation as compared to the usual slush pits, the advantage lies in the fact that very little mud is used in the circulating system and that is practically all salvageable. The saving on several wells may easily amount to many thousands of dollars.

Rotary mud has been a difficult problem in the Hobbs field, but not so difficult as one might infer from some of the reports which have been circulated. The problem has been to secure and maintain a rotary mud which will (1) have sufficient weight to hold the gas pressure, (2) have sufficiently low viscosity to resist oil and gas cuttings, and (3) allow gas to pass through freely enough to prevent the building up of formation pressures. Thus far the solution of most practical value lies in the employment of methods which remove cuttings without loss of mud and which will maintain active circulation.

The result has been to reduce the hazard of blowouts, reduce pump repairs and decrease drilling time, all items of benefit to operators and contractors. In addition, there has been an elimination of a number of slush pits, and a saving of practically all the mud used, by salvaging the mud from completed wells.

The study and thought applied to the mud problem in the Hobbs field have been rewarded by good results. The work which has been done should be a good foundation for further improvement.



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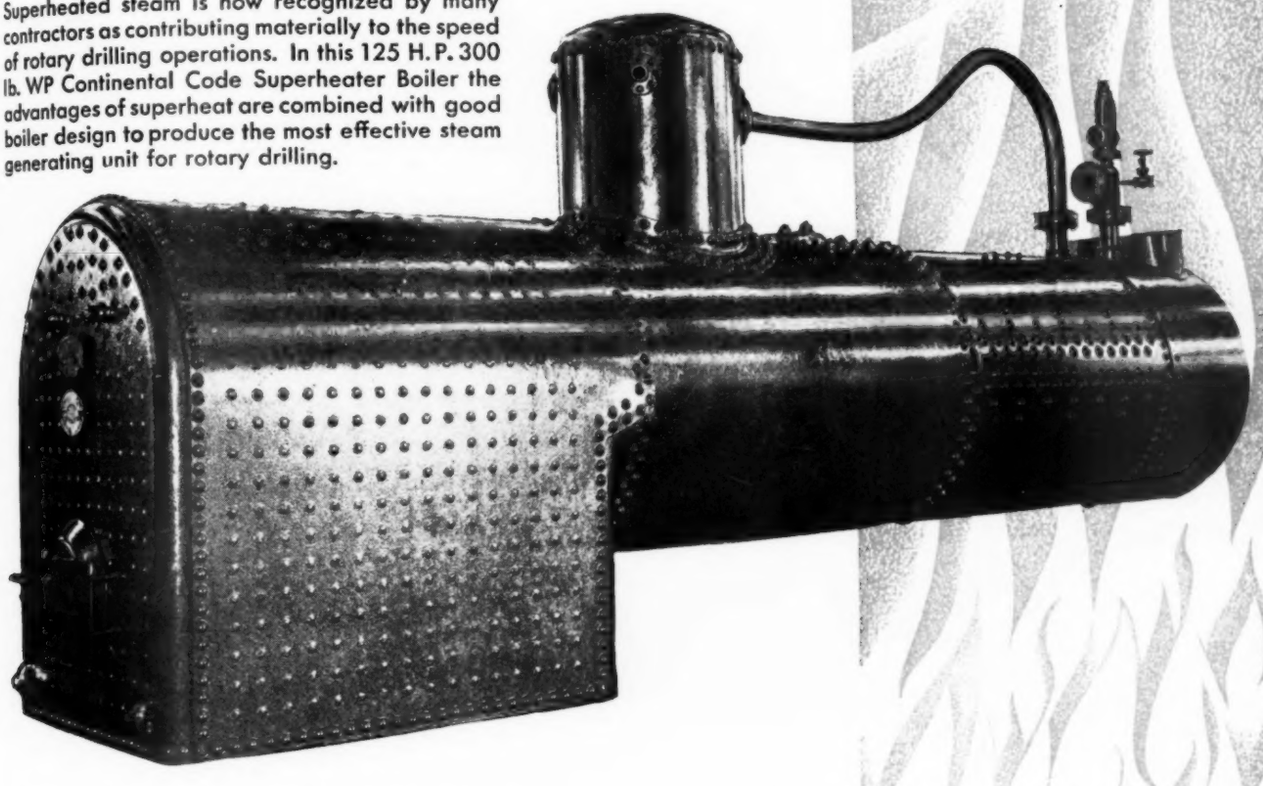

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# *Close Co-operation Needed for*
# Progressive Engine *and* Fuel Development

*By* EARL BARTHOLOMEW*

THE public is accustomed to changes in automobiles. The quarter of a century during which the motor car has been under development has seen a rapid evolution from the horseless carriage to the present all-weather vehicle that plays such a large part in our daily life. No one believes that anything approaching the ultimate in motor vehicles has yet been created. Unless all signs fail, we are on the threshold of the most radical changes that have ever been attempted in the design of automobiles, especially of power plants. The causes for the impending revolution of our conception of engines and the developments that are making it possible will be discussed later. Let us first examine the present status of the automobile.

The early automobile, although extremely crude, was a marked improvement over the horse and buggy. With the assured success of the new vehicle came an era of road building which has not ended, but today travel by automobile between practically any points in the United States is possible throughout the year. The automobile is now our most important means of passenger transportation and motor trucks are hauling a constantly increasing percentage of the nation's freight. The effect of the motor car on the determination of where and how we live needs no discussion. Suffice it to say that the automobile is one of the basic necessities of our modern civilization.

Independent Oil and Gas Co.'s gasoline plant at Wewoka, Okla.

As the distance between home and office or factory increases, the demand for greater speed, acceleration and economy increases. In view of the fact that the number and width of our highways can not be increased proportionately to the increase in the number of automobiles, it is essential that their average speed be stepped up by providing for greater acceleration after traffic stops.

In the industrial world motor vehicles are production tools differing in no respect in their function from the tools that fabricate them. In industry, efficiency is an advantage only when it results in economy. Fortunately these two quantities are usually proportional in motor vehicles. Engineering genius has succeeded in producing automobiles at a cost which reflects everlasting credit on itself. The same amount of engineering effort must now be applied to increasing performance and economy. The cost engineer knows that depreciation is only one of the items that constitute the cost of operation of a machine. Likewise he knows that a machine whose performance is not as good as it is possible to provide is usually expensive at any price.

The automobile has been carefully studied as a production problem. It is now being studied just as painstakingly from the standpoint of performance and economy. When a new machine far surpasses its predecessors in all respects, its possible efficiencies are likely to be overlooked for a while but when the new machine becomes commonplace, it is invariably subjected to every scrutiny that might improve its performance and economy.

The economy, or, perhaps better stated, the lack of economy of the present automobile is usually avoided as a subject of discussion except in the most highly technical circles. The provision of more space for an ever enlarging gasoline tank has perhaps been one of the major problems of the designing engineer. In the future we shall probably hear more and more about miles per gallon and ton-miles per gallon.

Industrial engineers know that slow transportation is expensive, hence the demand for more speed. The truck or bus which is slow on getting away makes fewer trips per day and is soon displaced by others superior in this respect because of a more favorable horsepower-weight ratio.

No discussion of the present status of the automobile would be complete without mention of its place in the world of sport. Hundreds of thousands flock to the race tracks annually to witness the motor speed classics. The importance of such events, however, is dwarfed by the millions of contests staged every day without prearrangement and without reward except for the satisfaction to be derived from the knowledge of the possession of superior acceleration. Our municipalities have unintentionally fostered these events by a liberal placing of traffic signals. Thousands of cars every year pass to other owners or to the scrap heap not because the performance is actually decreasing but because the performance is decreasing in comparison with that of the later models which enter the races. The culmination of efforts to provide increased acceleration by greater engine displacement calls for a new policy in engine design which is fast taking form. There are two kinds of research: One the

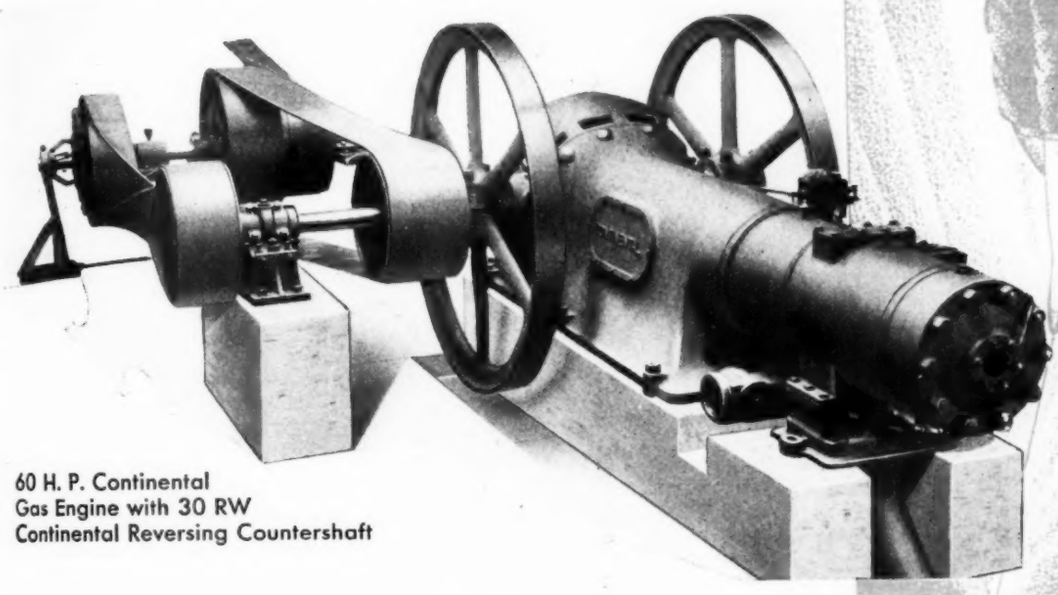
*Director, Engineering Laboratories, Ethyl Gasoline Corporation.

# WELL BALANCED

## THE CONTINENTAL SUPPLY COMPANY

## TWO CYCLE GAS ENGINE

*BUILT BY FAIRBANKS-MORSE*



60 H. P. Continental
Gas Engine with 30 RW
Continental Reversing Countershaft

*"If Continental Sells It....There Is No Better"* 766J

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# CONTINENTAL

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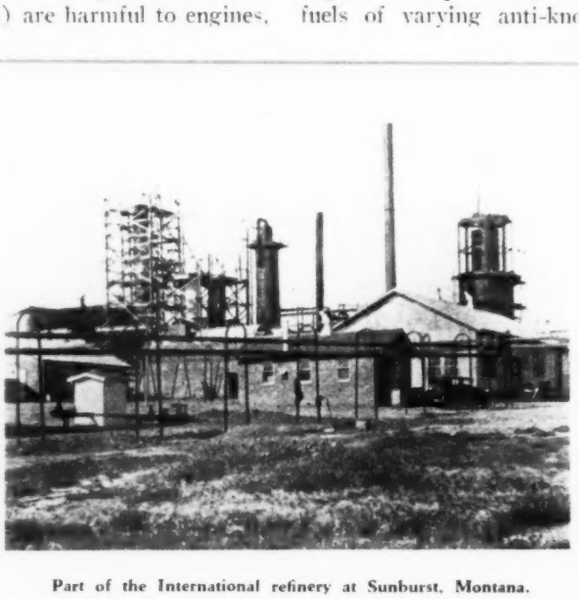
frenzied, superficial and oftentimes futile attempt to provide a product to meet the competition or anticipated competition of other manufacturers' products, the other the carefully planned and diligent development of basic principles which ultimately find their expression in products of fundamental improvement. The former type of research has predominated in the past in the automobile industry, but the latter type is now being widely carried on.

A new conception of the internal combustion engine is needed. It can perhaps be said also that a new conception of automotive fuels is needed by a portion of the oil industry. Oftentimes we find ourselves so busy polishing the rough edges off a product we have had for some time, that we fail to see the need or possibility of a superior product of different design that might be created. Although the history of the internal combustion engine is short, it is long enough to have permitted the establishment of standards and limits which have no basis in fact. A host of commonly accepted beliefs has grown up, among which may be mentioned the impression that compression pressures beyond a definite value (usually those now employed) are harmful to engines, that engine roughness is in direct proportion to compression pressure, that cylinder dimensions have no effect on detonation, that increased performance is easily obtained by increased displacement and so on *ad infinitum*.

If the engineers who now design engines had never seen one but were suddenly handed all the fundamental data which we now have concerning the mechanism of combustion, the properties of fuels and metals and the efficiencies of engine cycles, it is very probable that at the beginning an attempt would be made to design an engine which would utilize metals and fuels as efficiently as possible and it is equally probable that the standards and limits which would be evolved would be quite different from those with which we are familiar.



Part of the International refinery at Sunburst, Montana.

The history of internal combustion engines finds its counterpart in the history of steam engines. Watt's engine was of the reciprocating type and the efforts of designers for a century following were concentrated on this type. Compound engines were evolved for the more efficient expansion of steam and fairly good economies were attained. There came a time, however, when power and economy were required far in excess of anything the reciprocating engines could develop. While the changes to be wrought in automotive engines will probably not mean the abolition of the reciprocating principle, the reduction in size and improvement in economy will probably equal the corresponding developments in steam engines.

The story of the vain attempts to increase performance, by providing larger engines, is familiar to all. Larger engines have been heavier and have required larger and heavier chassis. The tendency of the larger engines to detonate has prevented the fuel utilization of the possibilities of anti-knock fuels, and has in a few cases caused a reduction in the power output per unit volume of engine through a reduction in compression ratio. The effect of the larger engines on the performance of the car itself, has often been opposite to the result which had been expected. Fuel consumption has rapidly increased.

Greatly increased performance is possible only through the development of greater power per cubic inch of engine, either by an increase in engine speed or by an increase in engine efficiency. There is a state of confusion at present during which some engineers are attempting to reduce engine speeds while others are attempting to provide for the safe and smooth operation of engines of higher speed. With smaller engine cylinders becoming quite popular, and oil coolers and air intake silencers already in use on a number of cars, it appears that there are real possibilities for pushing engine speeds to a higher figure, especially in those cars which use the four speed transmission.

Higher engine efficiency is made possible only by higher compression ratio, which, as is well known, is inseparably associated with anti-knock fuels.

The last two years have added greatly to our knowledge of the performance of various types of engines on fuels of varying anti-knock value. It is now generally conceded by those who understand the problem that knock is a function of both the fuel and the engine, hence the absolute necessity for close co-operation of the oil and automotive industries in the development of high efficiency power plants.

The variable performance of fuels in engines of different types has far-reaching effects on both the oil and automotive industries. It enters into all discussion of the best refining processes and of methods for rating the anti-knock properties of fuels. When it is considered that two fuels may have equal anti-knock value when burned in one engine, but radically different anti-knock value when used in another, it is apparent that the refiner's problems are by no means simple.

A sigh of relief has generally been breathed by automotive engineers because of the opportunity presented by the introduction of eight-cylinder engines for the discontinuance of large bore cylinders. The effect of bore and, to a smaller extent, stroke on the possible efficiency of engines on a given fuel are almost unbelievable. On some of the new eight-cylinder engines it has been found possible to increase engine torque 12 per cent, by increases in compression pressure in connection with the use of Ethyl gasoline and a carbon remover. It should be borne in mind that an increase of 12 per cent in engine torque should produce an increase of approximately 20 per cent in rear wheel torque at low speed because of the somewhat low mechanical efficiency of the power transmission system. At high speeds the torque available for acceleration is always low, and an increase in engine torque brought about by an increase in compression pressure causes an enormous increase in acceleration. For these reasons, automobiles which are being operated today at compression pressures of 170 pounds on Ethyl gasoline, give a new conception of performance. The progressive automotive engineer will exploit the possibilities of the small bore engine to their economic limit.

## *Problems Found in*

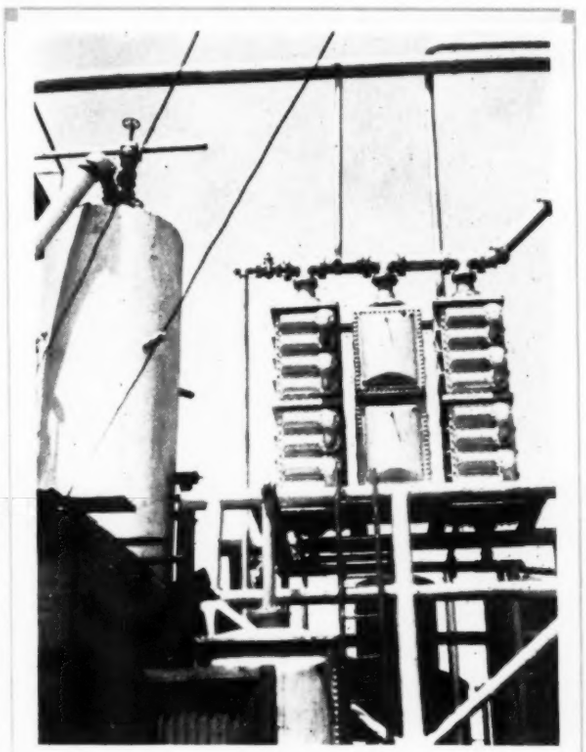
# Processing Texas Panhandle Crude

THE MacMillan Petroleum Corporation's refinery at Borger, Texas, was especially designed to handle Panhandle crude. The corrosive effect of this crude, due to its hydrogen sulphide, and its magnesium chloride contents, has been minimized in this plant by the refining methods and type of equipment used.

The plant has a capacity of 6,000 barrels of crude oil per day. The gravity of the crude ranges from 37 to 42 A.P.I., and contains from 30 to 35 per cent straight run U. S. Motor gasoline. The crude is topped, taking off gasoline, kerosene, and gas oil cuts. The residual is sold as fuel oil of 26 degrees A. P. I. gravity.

Crude oil from the storage tanks is pumped through the heat exchangers by means of a centrifugal pump.

The crude oil from the heat exchangers is washed in two vertical towers with water to remove as much of the salt content as possible from the crude oil. This contact of the crude with the water takes place at a temperature range between 150 and 170 degrees F. and under about 100 pounds per square inch pressure. The crude from the wash towers is pumped by means of a centrifugal pump through heat exchangers and a pipe still. The oil is heated to a temperature of approximately 300 degrees F. and then enters a cylindrical evaporator of the ring and doughnut type, which is shown in the accompanying picture. Here a large percentage of the lighter vapors is removed.



Evaporators, condensers and heat exchangers at the MacMillan refinery, Borger, Texas.

Considerable salt is withdrawn from the side of the tower near the bottom.

The oil is then pumped through another heat exchanger and through a second pipe still of similar design, where it is heated to approximately 525 degrees F. The oil flows under pressure into a small tower to the extreme left of the fractionating tower. More salt is deposited and withdrawn from the bottom of this tower. The oil is discharged in a stripping tower which is located next to the fractionating tower. The stripper is equipped with Boner-Sheldon plates.

The vapors from this stripper pass through three fractionating towers in series. These fractionating towers are the same type of design as the evaporator.

The fractionating towers are each equipped with 17 fractionating plates above the vapor entry, and six stripping plates below this point. Each tower is connected with a separate reflux pump and temperature controller. From the bottom of the third tower a 34 A. P. I. gravity product is removed. From the bottom of the fourth tower a 38 gravity gas oil is removed. From the bottom of the fifth tower a 41-43 gravity kerosene distillate is removed. From the top of the fifth tower gasoline vapors pass through a vapor line through a caustic scrubbing tower. Here the vapors are neutralized and pass through condensing sections in the top of the cooling tower and from there through the final condenser, shown in the photograph.

Some of the residual oil from the stripper is pumped through a third retort where it is heated to approximately 600 degrees F. and then into another tower just below the caustic scrubber tower. A light vapor, removed in the first evaporator, flows into this tower near the bottom, and by intimate contact with the hot oil from the retort are heated to approximately 525 degrees F., and these heated vapors then enter the stripping tower, located beside the fractionating towers about three plates below the inlet of the hot oil, and these vapors assist in removing the vapors from the hot oil coming from retort beside the fractionating towers. The bottoms from the vapor heating tower and from the stripping tower are then pumped through the vacuum tower. In this vacuum tower further distillates are removed and the bottoms constitute fuel oil having a gravity between 25 and 27 degrees A. P. I.

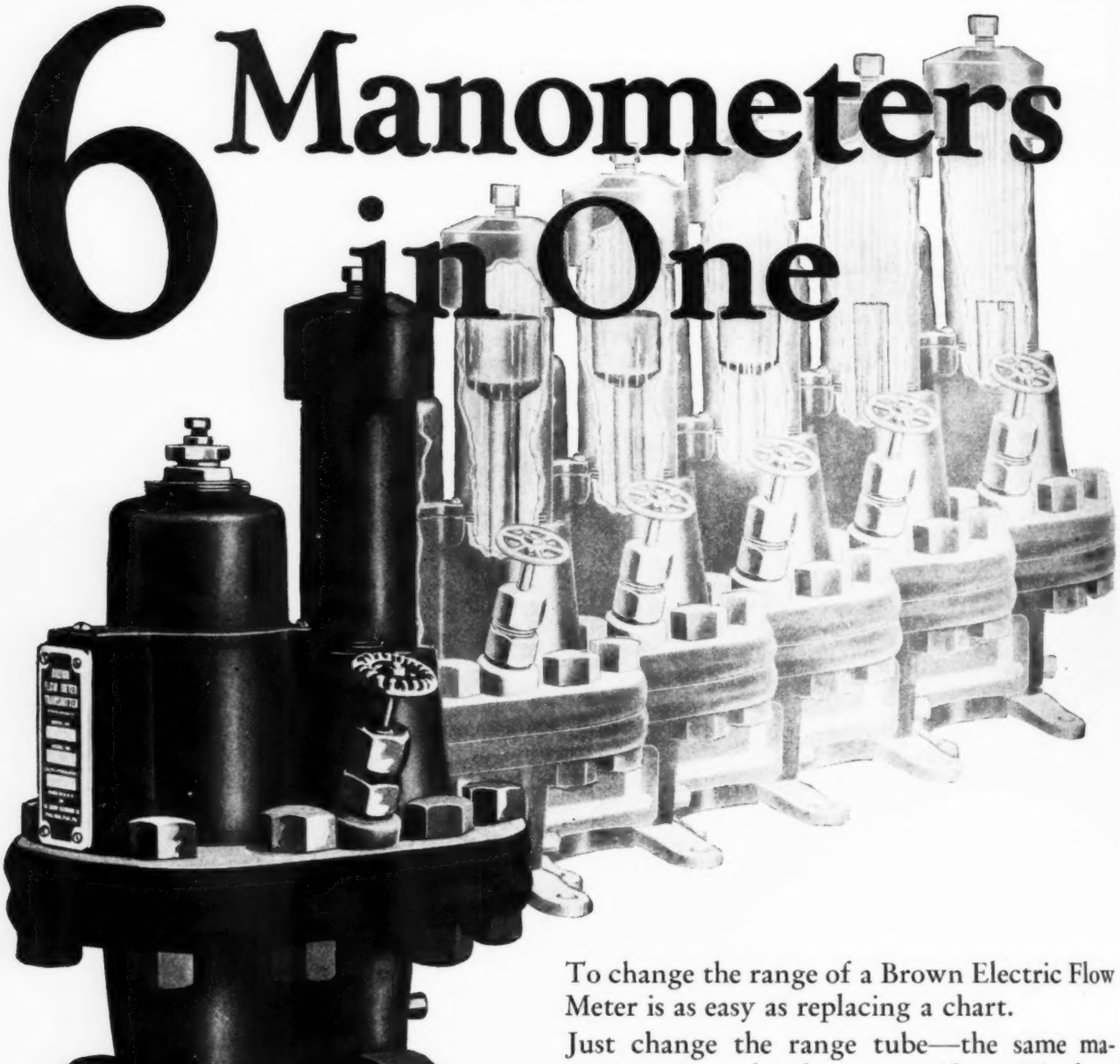
The bottoms from the three fractionating towers, gas-oil, 38 distillate, and kerosene distillate, are each separately and continuously pumped through coolers to the run down tank.

The gasoline is treated in a closed system continuously using sodium plumbite solution. The black strap formed by the reaction is filtered from the gasoline in a specially designed filter press. The treated gasoline meets U. S. Government specifications for sulphur and corrosion and is sweet to the doctor test.

The kerosene distillate is treated with sulphuric acid and is neutralized with fine clay. This clay is removed by filtering through a filter press.

The company maintains a chemical research and testing laboratory at the refinery to study special problems in connection with this type of crude; however, its main laboratory is located at Long Beach, California.

# 6 Manometers in One



***Brown Model 253 High Pressure Manometer---with 6 easily changed range tubes.***

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# Brown Electric Flow Meter

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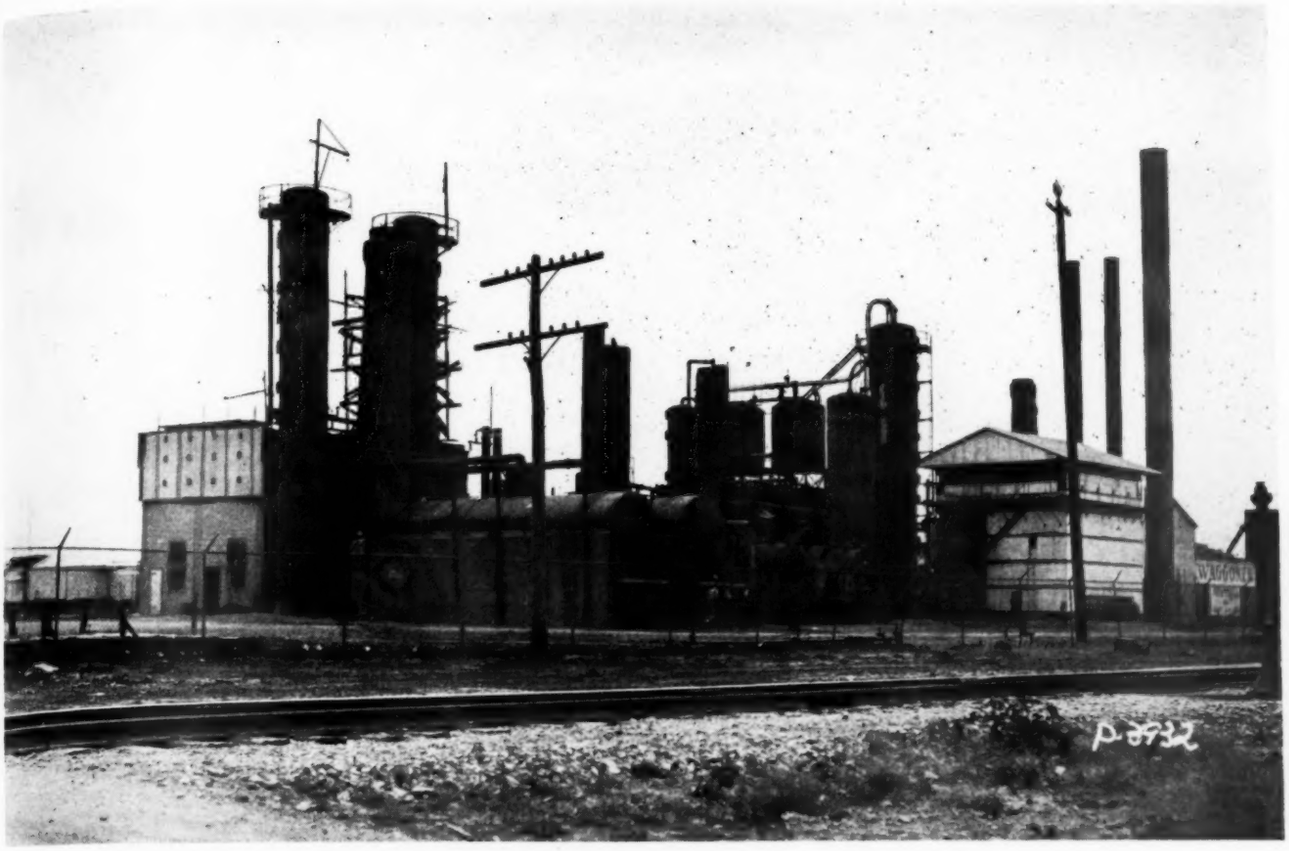


Wagner Refinery, Electra, Texas.

# The Manufacture *of* Soluble Cutting Compounds

*By* S. J. CAPLAN, *Chemical Engineer*

SOLUBLE cutting compounds both liquid and paste, when brought into solution with water, have very high heat-absorbing properties. These solutions are non-viscous, non-rusting and harmless to the hands of the men who are operating the cutting machines. The viscosity of these solutions approaches that of water, and because of this fluidity, the solutions make intimate contact with the cutting edge of the tool and the parts that are being tooled. These solutions therefore act as cooling agents and lubricants.

*Soluble Cutting Oil*

(A)

| | |
|---|---|
| Cocoanut Oil | 571 |
| Potash (88%) | 163 |
| Alcohol (denatured) | 285 |
| Water | 221 |

(B)

| | |
|---|---|
| W. W. Rosin | 271 |
| E. Rosin | 271 |
| Cocoanut Oil | 232 |
| Pale Mineral Oil (100 vis. @ 100° F.) | 7626 |
| Oleic Acid | 361 |

(1) Saponify (A) without applying heat. This saponification, on account of the presence of alcohol, goes to completion with very little stirring.

(2) In a different steam jacketed kettle, dissolve the rosin in 1626 pounds of mineral oil plus the oleic acid, plus the 232 pounds of cocoanut oil—with heat. Allow to cool.

(3) Mix the saponified alcoholic soap solution with the balance of mineral oil (6000 pounds).

(4) Now add the solution obtained from (2) to solution obtained in (3) and stir until perfectly clear.

*Soluble Cutting Paste*

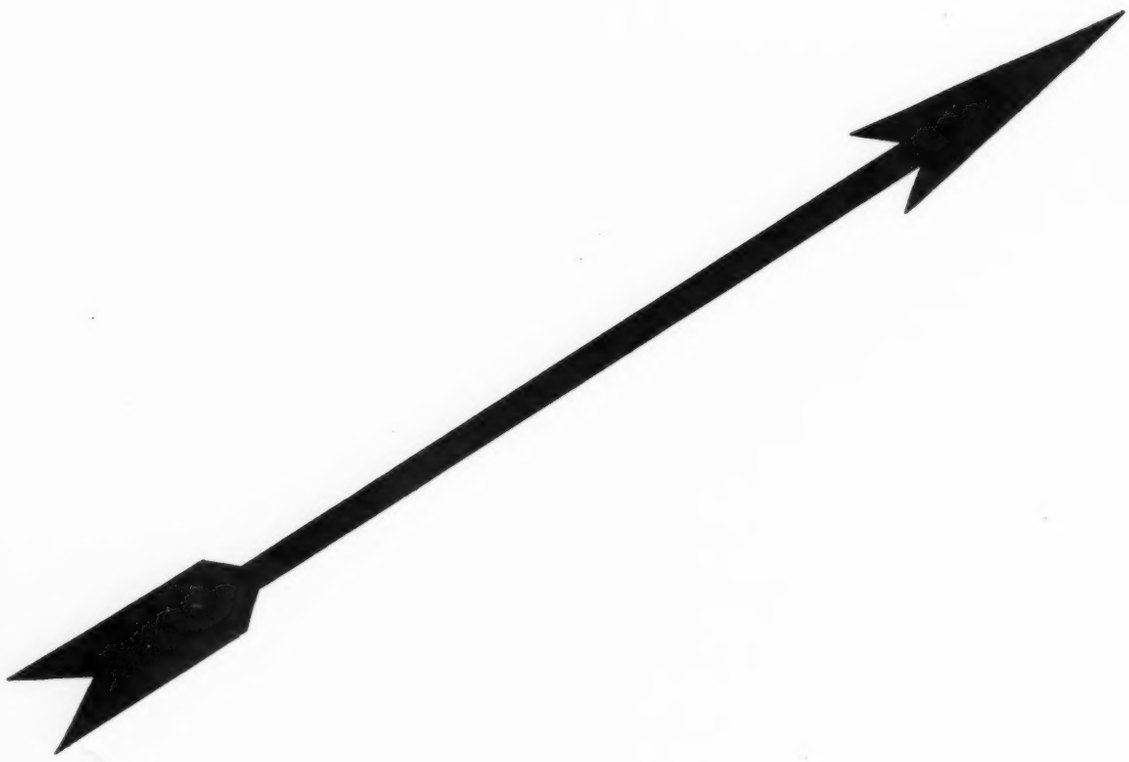
| | |
|---|---|
| Oleic acid | 846 |
| W. W. Rosin | 622 |
| Potash (100%) | 201 |
| Cocoanut Oil | 249 |
| Pale Mineral oil (100 vis. @ 100° F.) | 4975 |
| Water | 3110 |

(1) Mix the oleic acid and rosin in a steam jacketed kettle, with heat. Allow to cool.

(2) Then add mineral oil and the potash dissolved in three times its weight of water. Saponify in the cold.

(3) Add cocoanut oil and then crutch in balance of water. The finished product is creamy white.

The mineral oils and the above formulae may be varied. For ordinary high-speed work with comparatively thin cuts, these formulae will be found satisfactory. However, on heavy duty jobs, where deep cuts are taken at high speed, the formulae can be greatly improved by increasing the viscosity of the mineral oil.



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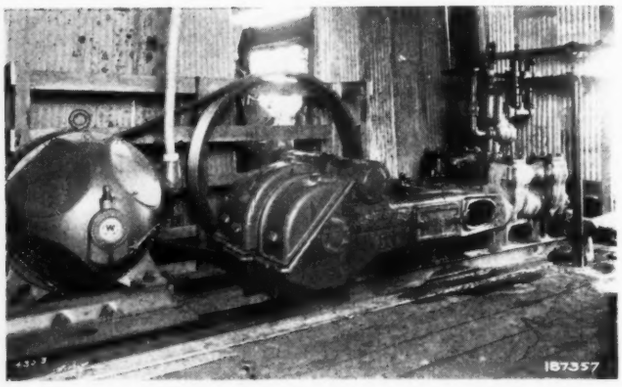
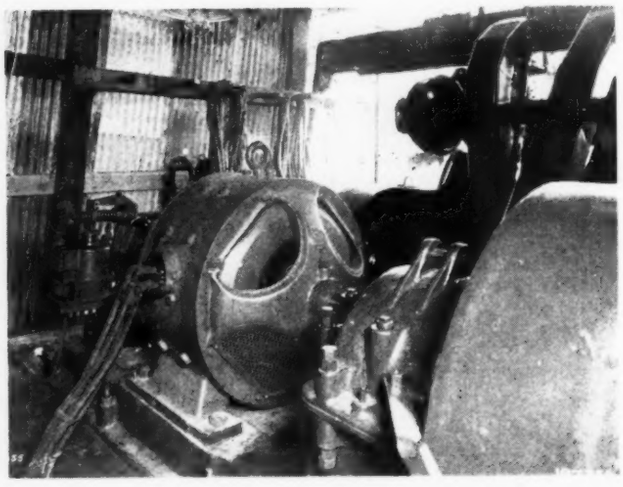
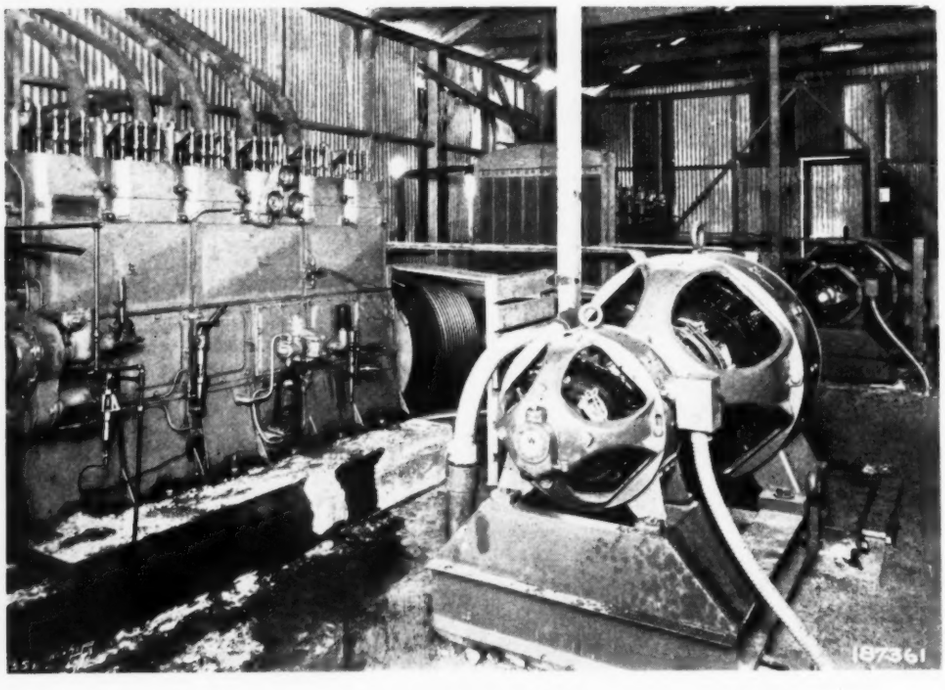
## *California Company Uses*

# Diesel Driven Units *for* Drilling Power






THE Standard Oil Company of California is using direct current for drilling its Vickers 24 in the Inglewood field of the Pacific Coast state. The feature of the operation and performance of the installation thus far has been its flexibility and smooth acceleration.

The equipment used on the installation includes two 200-horsepower, 450 revolutions per minute, four-cycle, six-cylinder Diesel engines, each of which drives, through a V-belt drive, a 125-kilowatt direct current generator at 1,200 revolutions per minute.

The current thus generated is supplied to a 125-horsepower, 250-volt, 900 revolutions per minute, motor driving the slush pump and to a similar drilling motor, which has a dual rating of 125 horsepower, 250 volts and 450 revolutions per minute when drawing current from only one generator and 250 horsepower, 500 volts, 900 revolutions per minute when the two generators are operated in series.

The current passes through a variable voltage control panel, and is regulated entirely by a master control on the derrick floor which actuates the resistance tubes and contacts in the control panel.

The two units are used partly as a protection against a breakdown of the power supply; drilling can be carried on with only one generator working. While drilling ahead, the two generators are run independently, one operating the slush pump and the other the motor which runs the draw works and the rotary table. However, for the purpose of pulling out or pulling casing, which require extra power, the power of the drilling motor is doubled by cutting out the slush pump motor and using the current from the two generators connected in series for operating the drilling motor. The power plant and the variable voltage control panel are situated in a power house about three hundred feet from the rig—to avoid the possibility of fire. Twenty-six small wires run from the power house to the motors. Although the generators, switches and Diesels in the power house are not vapor proof, both the motors are totally enclosed to avoid the possible ignition of gas by electric sparks.

**Top to bottom—The mud pump installation. The drilling motor. Diesel engines driving generators.**

**TALK NUMBER ELEVEN BY A PROMINENT DISTRIBUTOR**

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The above statement is characteristic of those made by prominent distributors all over the country. It explains in part how the Industrial Supply Distributor, helping to solve the important problem of broad markets and economical distribution, upholds high quality, maintains fair prices and saves needless efforts on the part of both consumer and manufacturer.

Challenger Transmission Belting—a square edged belt without seams to open up—with body sufficient to hold belt fasteners—with very little stretch and a gripping power that reduces power losses caused by slippage.

Recommended for heavy or troublesome drives.

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# Control and Regulation of Gas Pressure and Flow

*By* T. H. BEALS, *Cities Service Gas Co.*

IN THE transportation of natural gas, proper regulation of the flow is an important factor. This is not difficult, if the market is industrial in nature, as the demand for the gas will then be practically constant, but if the gas is being supplied to a city for domestic use, a flexible and efficient method of operation is necessary. The fluctuation in demand for domestic gas is both seasonal and hourly. During the cold winter months the demand is always the greatest, but it is especially so during the morning hours when all the fires are turned on both for cooking and heating. During the spring and fall, when the temperature changes are sudden, a method by which the pressures within the lines can be increased or decreased in the shortest possible time is desirable. The pipe line system equipped with compressor stations is the best adapted to these requirements.

The operator must be furnished daily and sometimes hourly with weather reports and forecasts. It is also necessary to have complete information at all times as to the pressure at strategic points, and the volumes of gas delivered to major consumers over the system. With this information and with experience, he can intelligently instruct the men in the field to open more wells into the line and to start additional compressors if a cold wave is expected, or the pressures are becoming low. He must see at all times that the pressures are high enough to insure an adequate supply of gas to the consumer. However, the pressures should not be allowed to become excessive, as the pipe lines are then placed under unnecessary strain, the leakage is increased, and the danger of blowouts and interrupted service is greater.

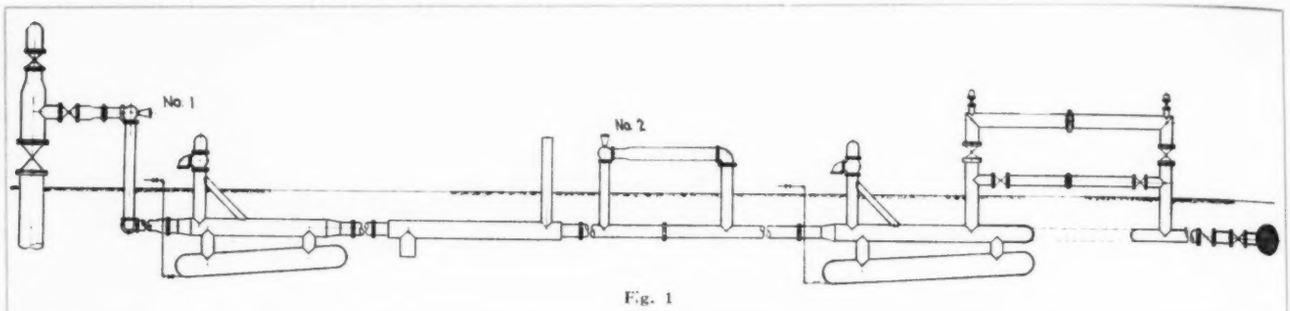



Fig. 1

It can be readily understood that a large force of men is needed to operate the compressors, turn in or shut out wells, make repairs on the lines, observe and report pressures and volumes and change adjustments on flow control devices. It would be entirely possible to manually operate valves and thus control the flow and pressures over the

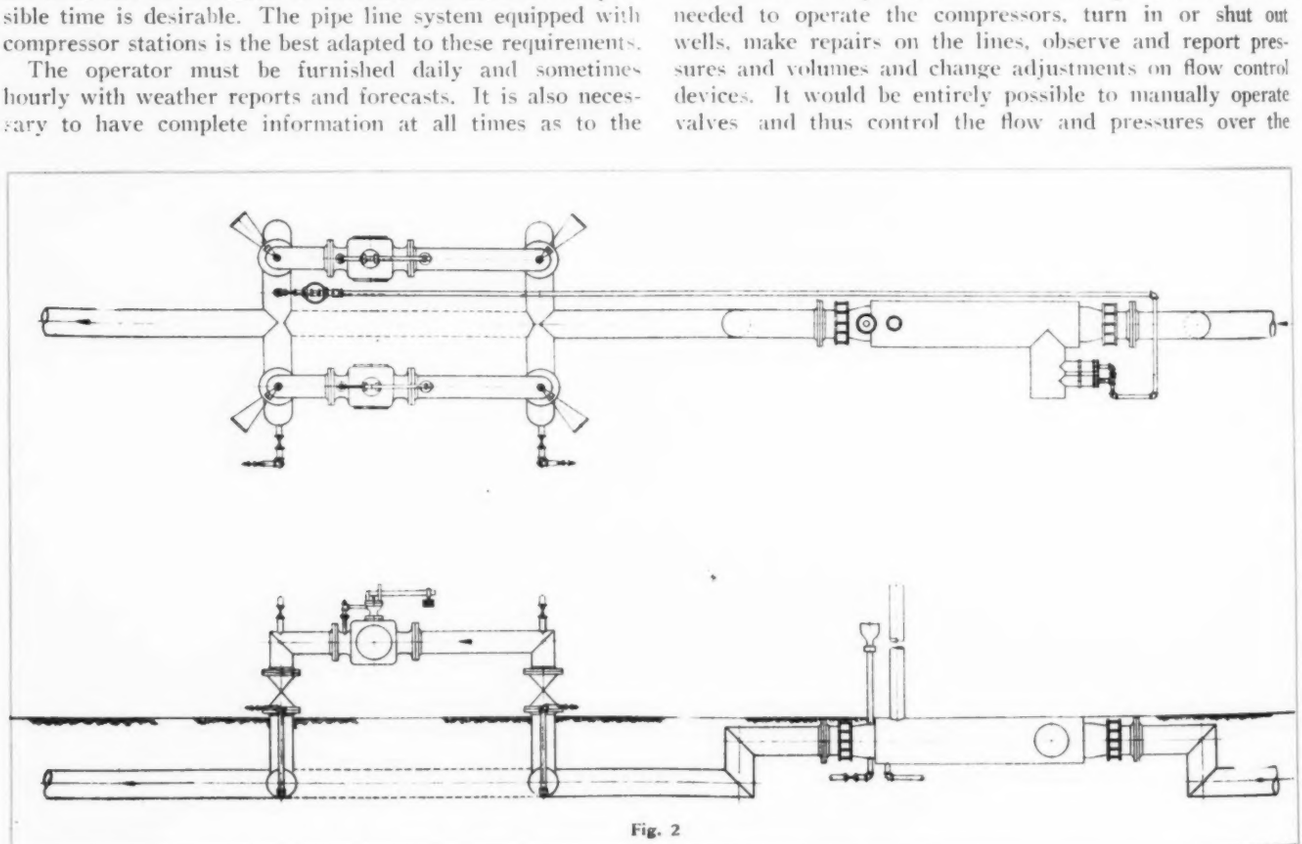
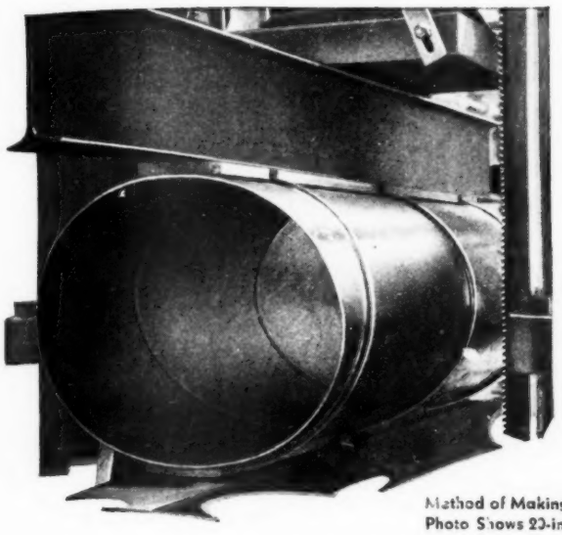


Fig. 2



Method of Making Crushing Tests.
Photo Shows 20-inch Naylor Pipe.

# Authoritative Tests Prove Remarkable Resistance To Crushing Action In LIGHT WEIGHT Naylor Pipe

External crushing tests on Naylor Pipe recently conducted by Professor M. L. Enger and W. M. Lansford at the Materials Testing Laboratory of the University of Illinois show:

| Diameter In. | Thickness In. | Load at Yield Point Lb. per Ft. | Vertical Defl. Yield Point In. | Max. Load Lb. per Ft. | Computed Load at Yield Point Without Spiral Joint Lb. per Ft. |
|---|---|---|---|---|---|
| 6 | 0.109 | 4000 | 0.24 | 7100 | 1010 |
| 12 | 0.141 | 2800 | 0.45 | 4200 | 930 |
| 20 | 0.141 | 1000 | 0.45 | 2000 | 580 |

The last column in the table gives the computed load required to stress to the yield point a plain pipe of the same thickness as Naylor Pipe. A comparison of these values with the experimental values obtained on Naylor Pipe brings out clearly the stiffening effect of the Naylor *Spiralweld* lock-seam.

Another feature of Naylor Pipe structure disclosed by these tests is its ability to transmit loads at considerable distances along the length of the pipe due to the flexible *Spiralweld* lock-seam construction. As a result, loads applied to small areas of the pipe would have to reach relatively large values to bring about a collapse of the length which would be affected.

These authoritative tests are indisputable evidence that remarkable resistance to crushing action has always been one of the definite features of *light weight* Naylor Pipe. A fact that Naylor Pipe has demonstrated in the field. Catalog 30-2 gives more complete engineering and metallurgical data.

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

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**Naylor Pipe**

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Standardized Naylor Pipe is made in sizes 6" to 12" I. D. and 14" to 20" O. D. in any uniform length desired up to 40'0". Ends made to wrought pipe standards for all types of coupling.

Toncan Copper Molybdenum Iron possesses a superior corrosion resistance, making it the favored pipe material.

Where corrosion is not a problem, Naylor Pipe can be furnished in steel.

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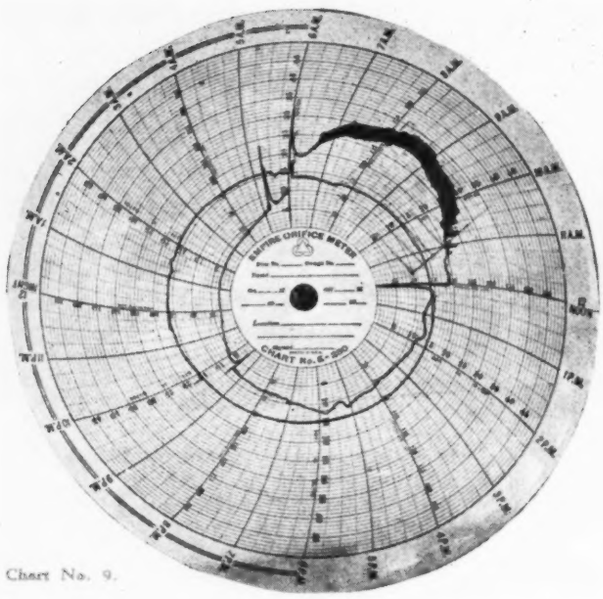

Chart No. 9.

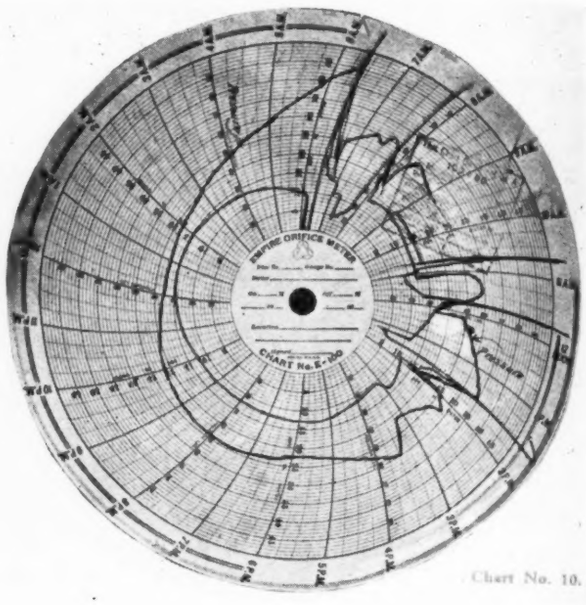

Chart No. 10.

whole of any pipe line system. In other words, men could be located at all points along the line where reductions in pressure are made, such as at branch line junctions and town border stations, to operate valves, thus regulating the pressure and flow. It is obvious, however, that the operating cost of such a method would be prohibitive. In order to meet the demands of the industry for accurate and safe pressure control, various pressure and flow control devices have been developed.

The two main points where pressure control devises are used are at the wells, and at the town border stations. Let us first take up briefly well control. Pressure regulators are used somewhat in this work, and thin plate orifices, short tubes and flow beans are also employed.

The thin plate orifice is generally installed in a two-inch pipe from the well, and its size is calculated by means of the critical flow formula. Due to the relatively small amount of metal in contact with the flowing gas, the orifice will not become clogged with ice, which is formed by moisture in the gas freezing, caused by the great temperature reduction which results when the gas expands from a very high pressure to one which is lower.

Short, heavy walled tubes, about 18 inches long, generally three in number, all having holes of different diameters, have been used with success on very high pressure wells. The flow and pressure can be varied by using tubes of different sizes.

The flow bean with its variable orifice is very satisfactory as it is extremely flexible as to operation.

Figure 1 shows the diagrammatic layout of one method of connecting a high pressure well to the pipe line system. Assuming that the working pressure of the well is 1,500 pounds, the pressure reductions at the two flow beans will be approximately as follows: No. 1 from 1,500 to 800 pounds to line pressure, which in this instance (see chart No. 1) is 300 or 400 pounds. It will be noted from the chart that the control device is discharging gas at a very constant pressure. At the point where the differential and pressure line drop suddenly, the flow was reduced by operating the control valve. When once set, a satisfactory control device will hold the flow constant. As long as the demand is fairly constant, the adjustment of the device

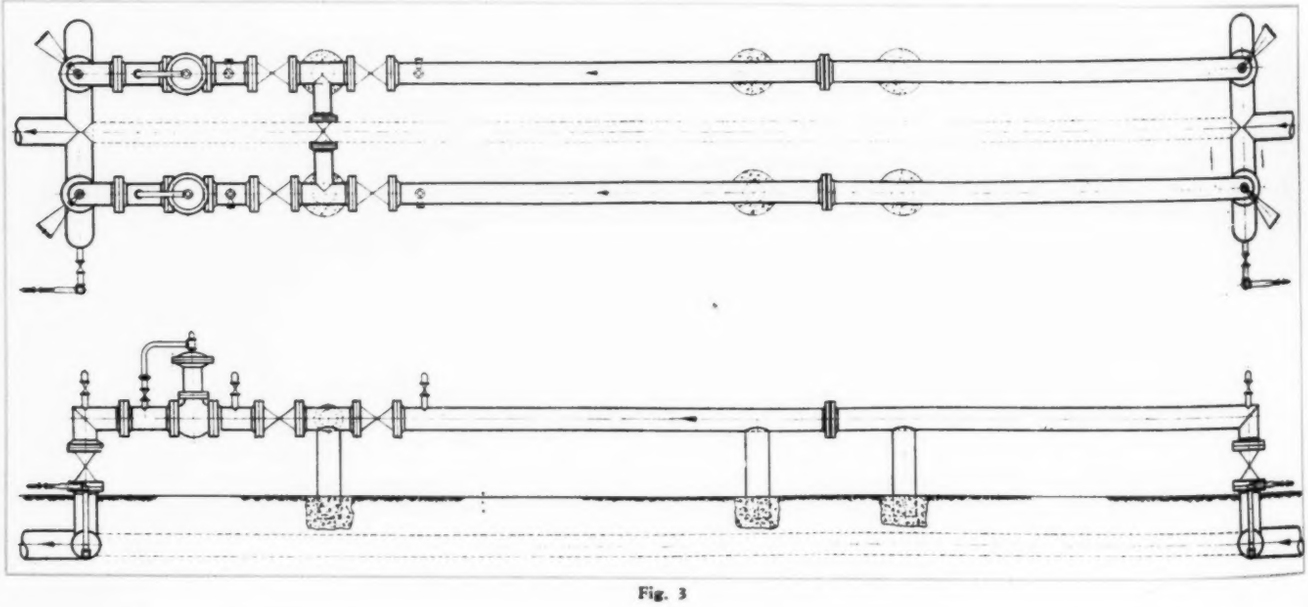

Fig. 3

# *If you could check over our orders*

**A SURVEY of our pipe wrench orders over a period of more than 40 years would show that peaks and valleys are no novelty in the development of the oil industry. Naturally we've sold more Trimo wrenches in good times.**

**But the most interesting fact—and it is as important to you as to us — is this: the outstanding favorite wrench to fill the oil man's needs has always been, and is today the all-steel, drop forged TRIMO. No stronger, safer, more serviceable pipe wrench is being produced.**

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does not need to be changed. In some instances, the adjustments of cutting devices on particular wells are not changed for several days. Any variation in the amount of gas required from the field is taken care of by shutting in, or opening up additional wells.

To take care of water which is discharged by the well along with the gas, or which condenses out of it when the gas cools when expanding through the valve, drips are installed as shown on the diagram. The water falls by the force of gravity into the drip, and is blown off periodically. It can be seen that this type of drip will not catch any moisture carried along as spray with the gas. Drip designs have been recently worked to catch this entrained moisture. At present they are more or less in the experimental stage.

The water jacketed heaters shown are necessary, as during the cold winter months, the temperatures of the ground and air are both low, and also because of the pressure drop through the control device, the gas is cooled. The resulting temperature of the gas would be below freezing, and moisture in the line would therefore freeze and stop the flow of gas through the line. Occasionally the fire in the heater becomes extinguished, and field lines have been known to freeze solid. It is obvious that the burners should be protected from the wind, and should be of a type not easily put out without turning off the gas. On some wells of very high pressure, equipped with one cutting device, it is necessary to keep fires in the heaters both winter and summer.

Generally, no more pressure regulating is done until the gas reaches the town border regulating and measuring station. At this point accurate and constant control is highly essential. In the first place, the city lines are not designed to carry high pressure, and all chances of allowing the high pressure gas to enter the city must be eliminated. In the second place, an accurate measurement will not be obtained if the rate of flow through the orifice meter varies rapidly. To meet these demands, the pressure regulator was developed.

Let us suppose that we have a pressure of 150 pounds, and wish to reduce it to 15 pounds and maintain it at this pressure. The only practical means to do this is by means of restriction in the line. Also let us suppose that the restriction is the proper size to discharge the gas at 15

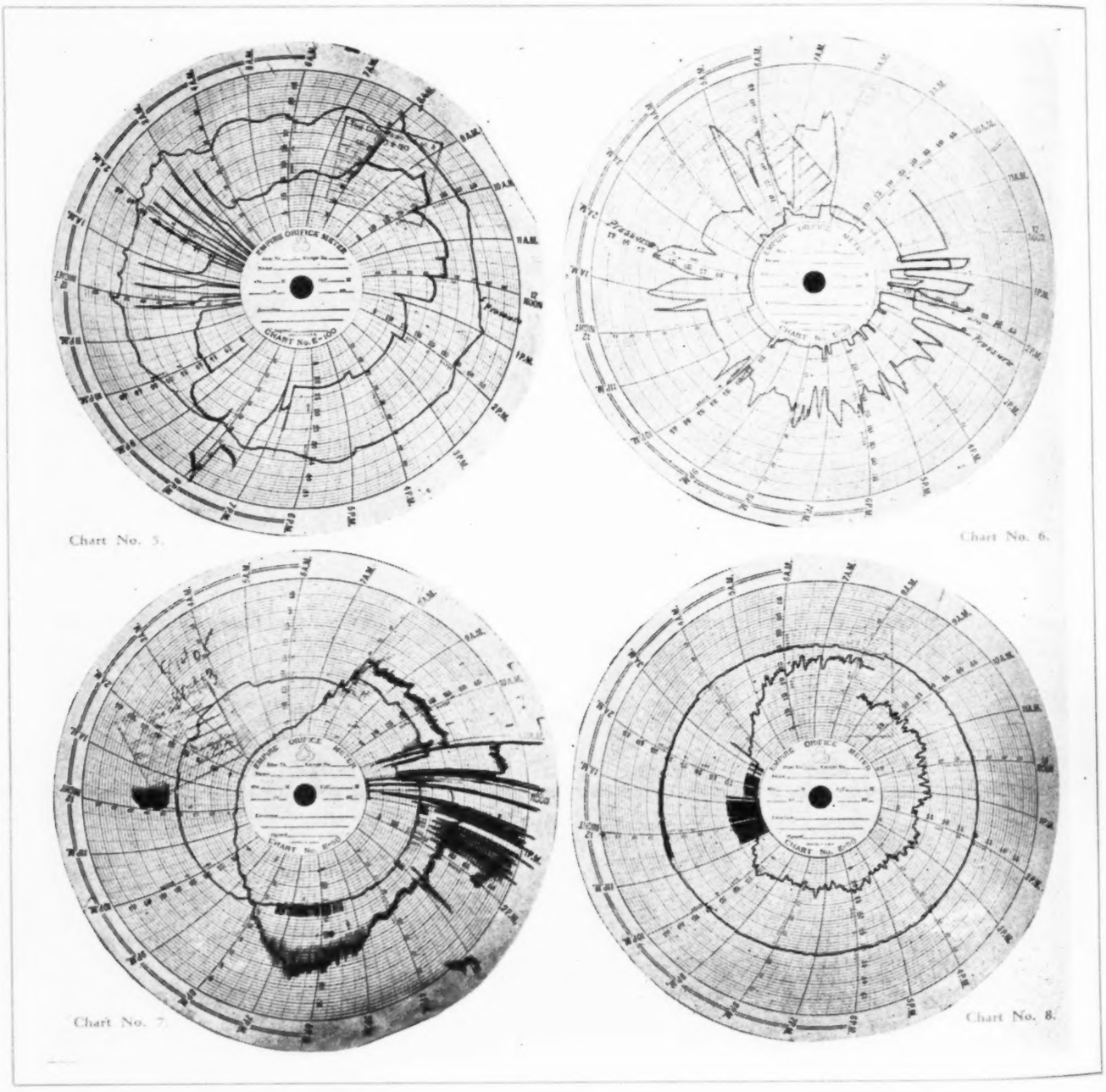

Chart No. 5.

Chart No. 6.

Chart No. 7.

Chart No. 8.

# SURWEL Clinograph

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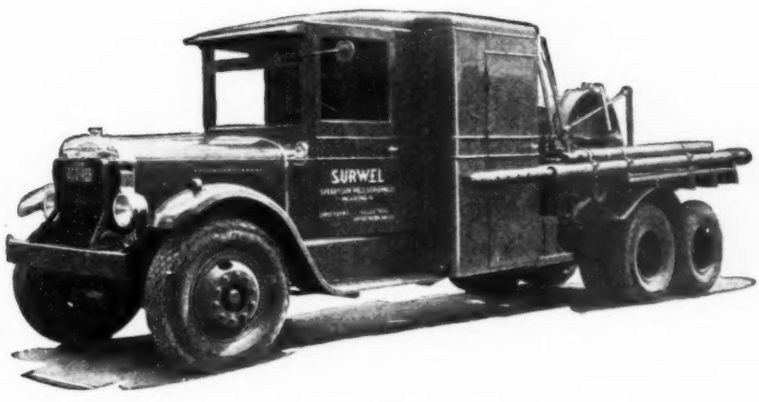

pounds pressure. If the demand increases, the restriction must increase in size to pass sufficient gas to maintain the 15-pound pressure. Also if the demand decreases, the restriction must decrease in size, or the pressure will build up over 15 pounds. The regulator automatically performs this task. If, however, the 15 pounds pressure in the lines is not sufficient to supply the demand, the adjustment of the regulator must be changed. As long as 15 pounds is sufficient any regulator of reliable manufacture will control the pressure within very small limits with the minimum of attention.

Following is a brief description of the construction and method of operation of any pressure regulator. A regulator consisting of four main parts:

1. The body.
2. Valve and connecting stem.
3. Head and control pipe.
4. Lever arm and weights or springs.

The main body of the regulator, in which is a partition containing an opening or openings, is flanged or screwed into the pipe line. The valve fits into this orifice in such a manner that when it is moved up and down, the opening is increased or decreased in size. Almost all regulators of large size are of the balanced valve type. In this type there are two seats on the valve, one above the other which fit into two corresponding valve parts in such a way that the gas pressure tends to open one while closing the other.

Connection between the valve and the diaphram in the head of the regulator is effected by means of a valve stem which passes through a stuffing box in the body of the regulator and is screwed to plates which clamp the diaphram in the head. One of the valves of the head is tapped, and is connected with the line on the low pressure side of the regulator by means of a small pipe known as a control pipe. One end of a lever, if the regulator is of the lever type, is introduced into a slot in the valve stem and fulcromed on the frame of the regulator which holds the head in position above the body. Weights are placed on the other end of the lever arm, and gas pressure is introduced into the head cavity through the control pipe. Thus we have two forces in equilibrum, one force created by the gas pressure on top of the diaphram, tending to close the valves, and the other force created by the weighted lever, tending to keep it open. By varying the head sizes and number of weights on the

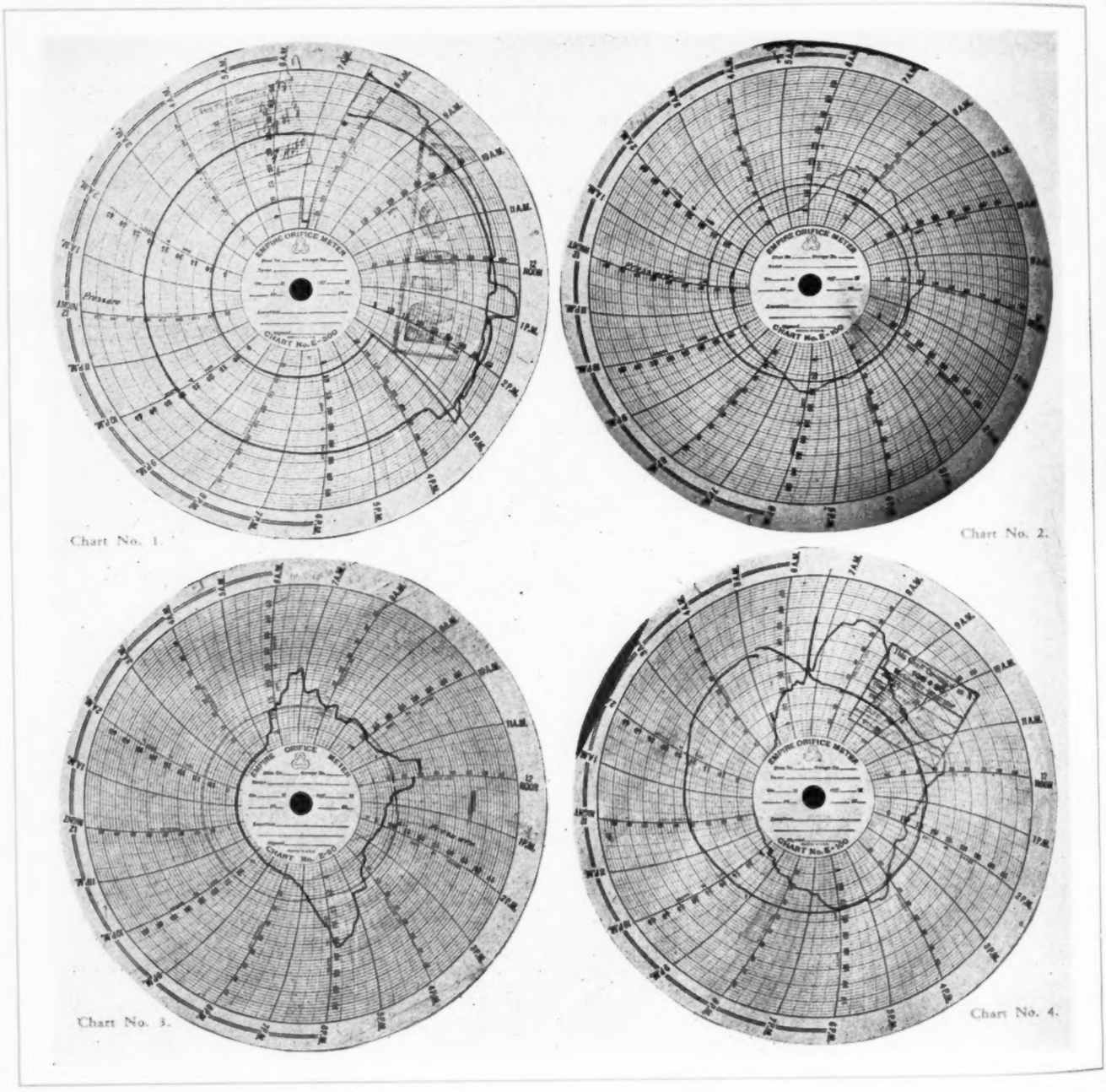


Chart No. 1.

Chart No. 2.

Chart No. 3.

Chart No. 4.

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lever, the regulator may be made to deliver gas at any desired pressure.

In the spring loaded type, the ultimate result is the same, but the force acting in opposition to the gas pressure in the head, is obtained by a compressed spring or springs. Variations can, of course, easily be obtained with this type by changing springs and heads.

Regulators are classified into three main groups:

1. High pressure.
2. Intermediate pressure.
3. Low pressure.

Exact pressure divisions of the three groups are, of course, impossible, but their range is somewhat as follows:

1. High pressure regulators are those which reduce the pressure from several hundred pounds to 50 or 75 pounds.

2. Intermediate pressure regulators reduce the 50 or 75 pounds to from 5 to 25 pounds.

3. Low pressure regulators reduce the 5 to 25-pound pressure to ounces.

It is thus seen that the strictly speaking low pressure regulators are those which are used only in town distribution work. This is not exactly true, as industrial plants using furnaces equipped with low pressure burners, require gas of a few ounces pressure, making a low pressure regulator installation necessary.

The main differences between the three classes of regulators are:

1. The bodies of high, intermediate and low pressure regulators are constructed to withstand different maximum pressures.

2. The high pressure regulator has hard steel valves and seats, while the seating surface of the valve of the intermediate and low pressure regulator is made of rubber or rubber composition.

3. The diameters of the heads vary, the high pressure regulator having the smallest head and the low pressure the largest.

4. Diaphrams used in high pressure regulators are still and not as flexible as the diaphrams in intermediate and low pressure regulators.

The pressure reduction at any town border station is generally made in two stages. In the first stage (see Fig. No. 2) the pressure is reduced from the main line pressure, to 25 or 50 pounds above the pressure in the intermediate lines of the town. This pressure reduction is effected by means of one regulator if the town is small, and two, or sometimes more, if large volumes of gas are being delivered. It is occasionally desirable on double regulator settings to have one regulator of a different size than the other. During the winter months, the larger one may be used, and when the flow is small, as in summer, the smaller regulator is put into service. A great deal of regulator trouble is caused by installing regulators which are too large. If the valve of a regulator operates very close to its seat, the effects of sticking, or binding of the working parts are much more noticeable. Also, as a positive shut off cannot usually be obtained by means of a regulator equipped with hard seats, gas will possibly leak by a regulator which is too large, thus building up the pressure above the desired volume. A positive shut off may usually be obtained by using a regulator equipped with seats made of rubber or rubber composition. However, it is not desirable to reduce pressures of over 100 pounds by using a soft-seat regulator. The high pressure regulator setting should be well blocked and the by-passes should be blinded.

Fig. No. 3 shows a town border meter run and low pressure regulator setting. These regulators are of the soft seat type. The same rules applying to size are also applicable to this setting. The arrows on both settings indicate the direction of flow. The gas is discharged from this low pressure setting, directly into the intermediate pressure lines of the town. The pressure on these lines will vary from 5 pounds to 75 pounds, depending on the size of the town. Pop valves are installed on the discharge of a town border regulator setting, as a safeguard against high pressure gas getting into the town lines.

Chart Nos. 2 and 3 are representative of town border meter charts where good regulation is obtained. Improper regulation will be indicated on the orifice meter charts in a variety of ways, depending upon the nature of the cause of the trouble. It will be noted that these charts are in direct contrast to Chart Nos. 4, 5, 6, 7, 8, 9 and 10. These last charts show the effect of different kinds of poor regulation upon the measurement. The cause of the poor regulation follows:

**Chart No. 4.**

This chart indicates that the regulator is either too large or that the valves should be cleaned or ground. It will be noted that the pressure gradually builds up when the flow is at a minimum.

**Chart No. 5.**

This chart indicates that the regulator valve stem is binding in the stuffing box, that there is play between the valve and stem, or that the valve is binding against the parts.

It will be noted that the differential line fluctuates widely when the flow is small, dropping to zero and remaining there for a time and then jumping suddenly to 35 degrees. This is probably caused by a slight play in the connections coupled with a binding of the valve.

**Chart No. 6.**

The working parts of the regulator delivering gas to the meter from which this chart was taken, are either very dirty or are out of alignment. Both will cause sticking as indicated on the chart.

**Chart No. 7.**

The effects on measurements due to a pumping regulator are shown here. Pumping can be eliminated by installing a restricting disc in the line as close as possible to the control pipe tap. The drop in pressure through this disc should be about 5 pounds.

**Chart No. 8.**

This chart indicates that play exists in the valve connections.

**Chart No. 9.**

The vibrating differential line is caused by the valve guides not fitting snugly in the parts.

**Chart No. 10.**

Freezing of water around the valves of the regulator caused the irregularities in pressure as shown.

What has been said will give some idea of the different methods of pressure control over a pipe line system with particular emphasis being given to poor regulation as shown on the charts.

*Use of the*

# Gas Lift System with Natural Gasoline Recovery Plants

*By* R. R. DEAN, *Consulting Engineer*

THE flow diagram illustrates a natural gasoline recovery installation in the Seminole field, Oklahoma, operated in connection with a gas-lift system used for flowing the wells. Although the efficiency of the gasoline extraction is perhaps lower than a type of installation involving high-pressure absorbers and distillation units, it has many unusual features.

The plant represents a total investment of $950,000 complete. About 30,000 barrels per day of crude oil is lifted in the wells. The plant recovers 30,000 gallons of grade AA natural gasoline daily. The operating costs based on the finished natural gasoline produced is .012 cents per gallon and the total cost is .040 cents per gallon. The production department is not charged for the gas to the wells.

This installation has the following characteristics:

(1) Low investment cost.
(2) Minimum operating expense.
(3) Simplicity of operation.
(4) Maximum yields.
(5) Complete control of gasoline quality.
(6) High salvage value, the only loss being concrete foundations.
(7) A minimum quantity of cooling water is required.

The fractionating tower has a capacity of seven million cubic feet of gas per day. It is 43 feet high and 48 inches in diameter. There are 16 bubble cap trays in it. In designing the tower, the area of each downcomer was made equal to 20 per cent of the plate area. This was necessary to eliminate gas-lifting effect due to the light constituents being fractionated.

The compressed gas and vapors enter the tower over the fifth tray. It is compressed to 350 pounds per square inch, and the temperature due to compression is about 310 degrees F. The distillation is carried on by means of a steam coil in the bottom of the tower. The vapor temperature on top of the tower is maintained by means of water-cooled dephlegmators. The condensate forms the reflux for the tower. A mist extractor is installed in top of the tower under the gas outlet.

The operation of the plant is very simple. The distillation and the grade of the finished product are controlled automatically by means of a pressure regulator on the steam coil. A definite steam pressure is maintained to a corresponding operating pressure on the tower, which, of course, fixes the temperature and pressure on the liquid in the bottom and determines the grade of natural gasoline produced.

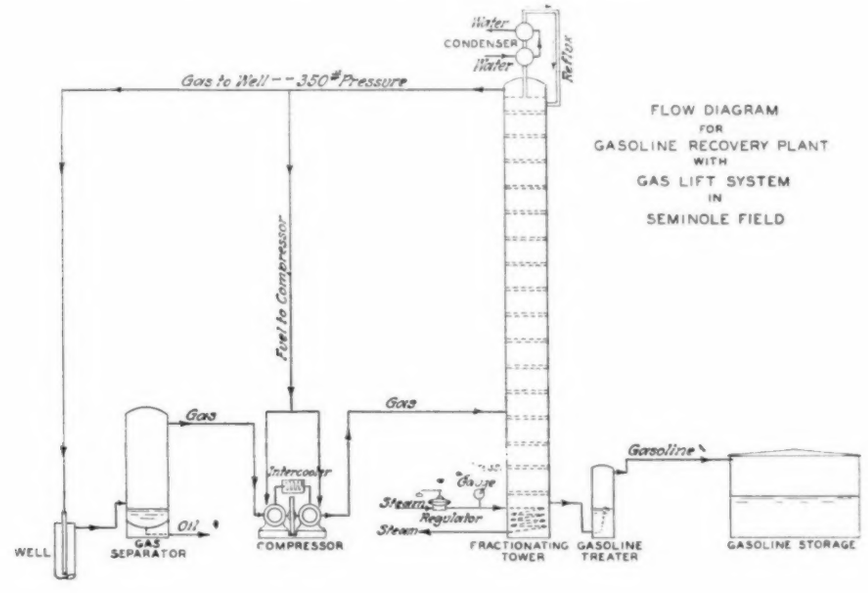
In this operation the propane content of the gas to the wells soon builds up to a point where the thermal value is exceedingly high, and it is necessary to dilute the gas for fuel to the engines. The high propane content of the gas also presented operating difficulties.

In operating this type of plant in the Seminole field it was found that the hydrogen sulphide present in the gas soon corroded certain parts of the equipment. It was found that the effect was most apparent in the upper three trays of the tower, and to a limited extent in the gas lines to the wells. Aluminum or lead coating can be used to reduce this trouble.

The gasoline produced in this field is slightly sour and requires a light chemical treatment to make it pass the doctor test. The gasoline from the bottom of the tower is bubbled through a treating tower containing a solution of caustic soda or lead plumbite.

The steam consumption for distillation is about 120 boiler horsepower per tower.

In the operation of the unit it was found that a surplus of gas accumulated.

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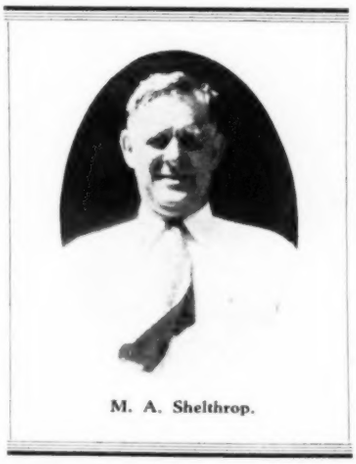
# Dehydrating Bright Stocks Under Vacuum

*By* **M. A. SHELTHROP,** *Refinery Engineer*

IN the manufacture of bright stocks during the last two years a good many developments have taken place which have proven very successful in improving the quality of these products, especially in regard to pour test, color and low carbon content. Among these are the attempts made by several refiners in dehydrating bright stocks under a high vacuum, which in several instances have shown gratifying results in improving the color of the stock, and in addition to this, have eliminated the slow and costly method of blowing the stock bright with air.



M. A. Shelthrop.

In blowing the stock with air the oxidizing effect on the hydrocarbons has a tendency to darken the color considerably, as it is often necessary in this manner to blow the bright stock for over three hours before it becomes sufficiently clear to meet color specifications.

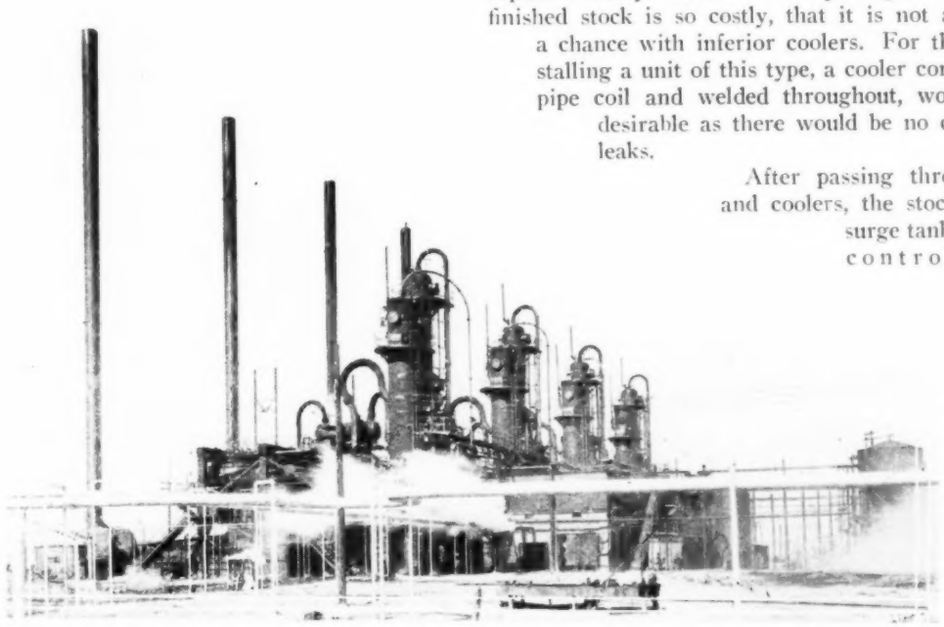
The vacuum tower to be considered can be operated very efficiently in conjunction with a continuous bright stock still. In this still, by stripping off the entire naphtha content, the stock is reduced to desired flash and viscosity and then charged directly to the vacuum column. In designing such a column it is of prime importance to allow for sufficient strength against the external pressure, a pressure that reaches its maximum when the vacuum approaches 29.9 inches of mercury; however, to obtain this high vacuum in ordinary practice is hardly possible, due to the difficulty in making the entire system under vacuum absolutely air tight. This is not necessary, as the recent experience of the writer has shown that a vacuum with a manometer reading of 27.5 inches of mercury gives excellent results.

As the thickness of the steel plates in a vacuum column is directly proportional to the external pressure in pounds per square inch, the diameter and the distance between reinforcing rings, it follows that the economical design of such a column would call for a small diameter. The primary purpose of this type of column is to remove all moisture contained in the stock and, as this moisture content generally does not exceed one-tenth of one per cent, the maximum amount of steam vapors formed throughout the entire length of column is exceedingly small. Thus, a tower of three foot diameter has proven more than ample to handle 600 barrels of bright stock per day.

For reinforcing rings in such a tower usually a safe method of calculation is to design a circular girder made of two angles, or, in cases where plates are used, one angle and tray-plate, which would carry a uniform load equal to the collapsing pressure on the tower between trays and reinforcing rings for a length of at least one-sixth of the circumference. A desirable arrangement of such a column is shown in the accompanying sketch.

The bright stock obtained from the bottom of the naphtha stripping column flows by gravity through a set of heat exchangers, giving up its heat to the wax-free oil that charges the still and then through a set of water coolers that cool the stock down to the desired temperature of approximately 180 degrees F. before being charged to the vacuum tower. This temperature, however, varies considerably, depending upon the method of design and operation of the tower. Great care must be exercised in selecting the above-mentioned water coolers, as the slightest leak in the tubes will produce free water in the stock and affect the entire operation by making the oil cloudy. Shutdowns on account of repair of leaky tubes and the spoiling of a day's supply of finished stock is so costly, that it is not advisable to take a chance with inferior coolers. For this reason, in installing a unit of this type, a cooler consisting of double pipe coil and welded throughout, would be the most desirable as there would be no chance for future leaks.

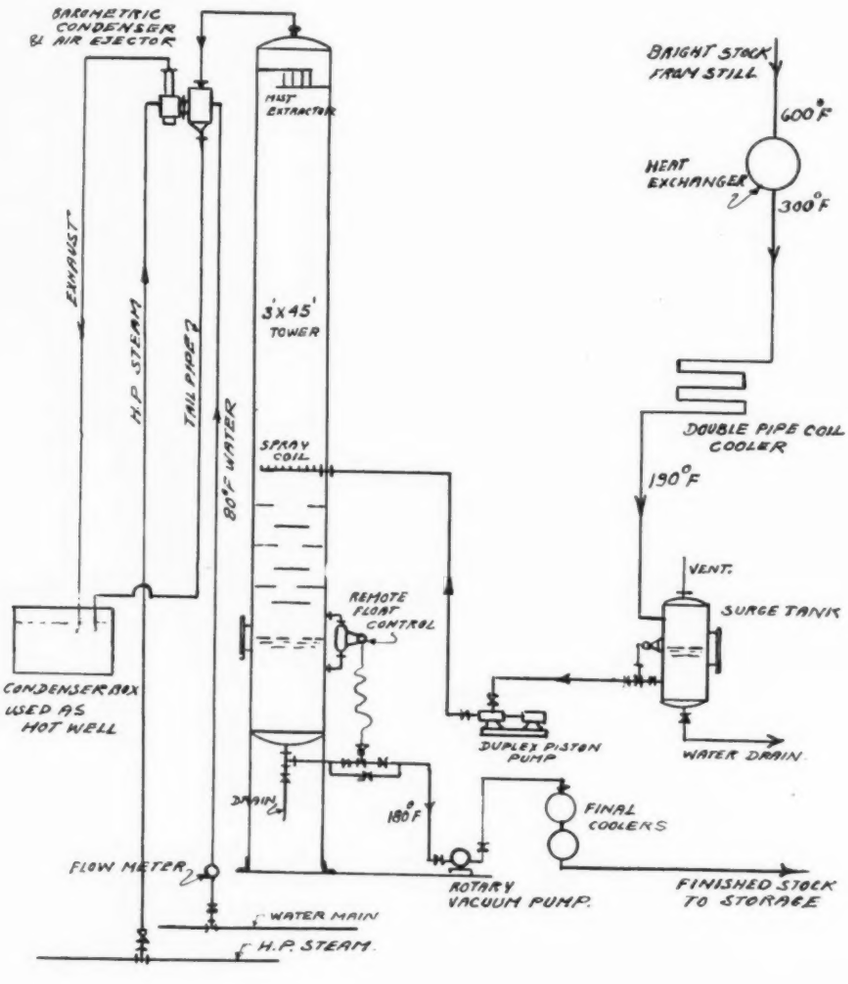
After passing through exchangers and coolers, the stock enters a small surge tank with liquid level control. The charging pump taking suction on this tank charges the oil under approximately



Battery of cracking units in the Cosden Refinery at Big Spring, Texas.

60 pounds pressure to the vacuum tower, where it enters the vacuum through a perforated pipe coil and is broken up into a fine upward spray. The oil immediately starts to foam and rise up through the column for a considerable distance. This is due to the fact that the water particles entrained in the oil are at once evaporated into steam. The boiling point for water under a 27-inch vacuum being lowered to about 85 degrees F., the oil bubbles that are formed under the expansion of steam rise rapidly through the column until they burst and the steam vapors being liberated are drawn off through the vacuum suction at the top of the column.

From the bottom of the tower the dehydrated stock is drawn off with a rotary vacuum pump and pumped through a set of after coolers to storage. To create the 27-inch vacuum on the tower an air ejector is used, designed for a 100-pound steam pressure, direct connected to a barometric condenser. The steam consumption of the air ejectors requires approximately 250 pounds to 300 pounds of steam per hour, while the barometric condenser operates with approximately 20 g. p. m. of 80 degrees F. water. In starting such a unit it requires approximately 25 minutes to half an hour to obtain a 27-inch vacuum, after which the oil is charged to the system. When installing this unit, the




To prevent small quantities of bright stock being drawn over through the barometric condenser, it is a good precaution to place a mist extractor in the top of the tower. Directly under the spraying coil are a number of baffle plates so arranged that the oil is again broken up in its fall from one plate to another until it reaches the liquid level in the bottom of the tower. From this is seen that the main features to be considered for this type of column are ample height and small diameter with sufficient means for breaking up the oil to a maximum exposed surface.

barometric condenser must be placed at least 35 feet above the water level in the hot well so that the water column in the tail pipe will balance the maximum barometric pressure. Great care must be taken in making all flanged connections and manheads on the tower, as well as all pipe connections in the vacuum system absolutely air tight, as otherwise it is not possible to obtain a real high vacuum.

With this method of operation it has lately been possible to improve the color of bright stocks as much as one-half to three-quarters of a point on the Tag-Robinson scale.

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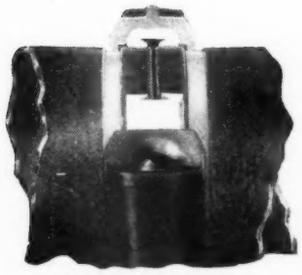

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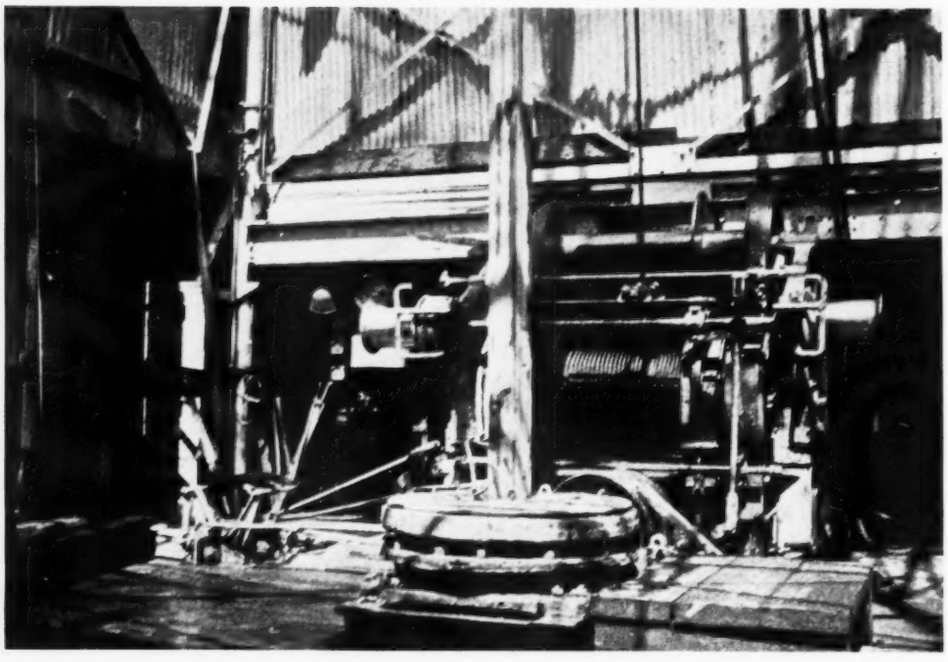

Fig. 1

# Gasoline Engines For Motor Driven Rotary Rigs

THE rotary method of drilling has so established its position in the oil industry that it is now almost universally used for deeper drilling in proven areas. While its use in wildcat territories is by no means new, many conditions are there adverse to the heavy type; and these conditions have led to the development of a lighter type of equipment. The Union Oil Company is making a test with this type of rotary equipment which is driven by direct-current motors. The power is generated by internal combustion engines using distillate for fuel.

Water is frequently unavailable or unsuitable for steam generation, while electric power can seldom be found in isolated districts. The gasoline engine has been used to some extent as the prime mover. Direct-current electricity also seems to offer a satisfactory power and previous tests have proven its use feasible for rotary drilling.

The design of the rotary drilling equipment itself, however, is of the greatest importance. Any amount of power can be supplied to drive any equipment; but if that equipment is to meet the duty imposed upon it in the most efficient manner, it must incorporate definite features. It must be readily transportable—if not actually portable in the true sense of the word. It must be able to meet severe conditions when they arise and must be able to drill comparatively deep holes. It must be adaptable to the power available and must perform well with that power.

The well on which the equipment is being tried out is La Merced No. 29 in the Montebello field, which lies east of Los Angeles. The location gives the oil company and the manufacturers of the equipment every opportunity to observe its performance. The drilling equipment has already passed beyond the experimental stage, so that the greatest interest lies in the performance of the portable generation

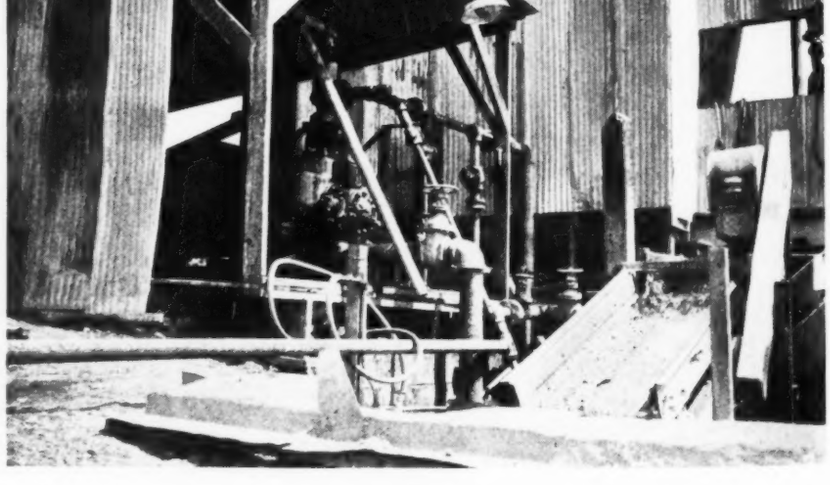

Fig. 2

plant and the efficiency of direct-current operation. The motor, the drawworks and the rotary table are mounted on one steel frame. This assembly was made by the Doheny Stone Drill Company and is practically a portable unit, although it is necessary to slide it from the truck on which it is hauled and set it up on the derrick floor. It is shown while drilling in Figure 1.

The motor operating the drawworks and the rotary table is a 100-h. p., shunt-wound, direct-current motor with a maximum speed of 1500 r. p. m. It is equipped with a blower which forces all air that may be gas-laden to the outside.

The drawworks is a 2-C Type Hydril. As can be seen in Figure 1, it is a compact, self-contained unit that readily lends itself to portability and is most adaptable to this kind of installation. The power from the motor is transmitted to the drumshaft and the rotary clutch through a three-speed transmission of the selective type in a cast steel oil-tight case. The spooling drum is mounted on roller bearings and floats on the drumshaft. One end of the drum has a spiral jaw clutch which gives three fast speeds, while on the other end there is a planetary gear train. This planetary train is used in combination with the three transmission speeds to give three slow hoisting speeds for heavy loads and thus provide a total of six hoisting speeds for the spooling drum.

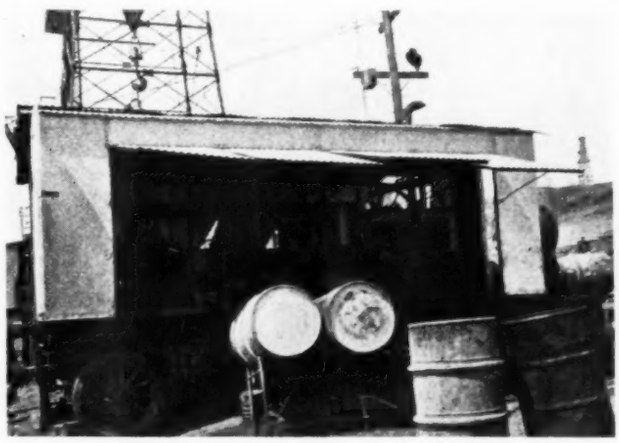

Fig. 3

The brake bands act on machined brake drums on the spooling drum flanges and are engaged direct to an equalizer bar built into the base. This arrangement permits independent adjustment of each brake with a positive safety stop and allows one brake to function should the other one fail to work. Special safety catheads are keyed to a shaft which is mounted on brackets and driven by a short chain from the drumshaft. This is enclosed with safety guards.

The dimensions of the drawworks are interesting. The height from the base to the center of the cathead shaft is 4 feet 7⅛ inches; from the base to the center of the coupling for the prime mover shaft is 12⅜ inches; from the center line of the drawworks to the face of that coupling is 3 feet 10⅛ inches; and the base dimensions are 4 feet 5¾ inches by 7 feet 5¾ inches. The sand reel is detachable and can be set up as desired by the operator instead of in place as shown in the illustrations.

The rotary table is a standard Union Tool Company type, but is direct connected to the pinion instead of through a sprocket. The illustration (Fig. 1) depicts the compactness of the equipment and indicates the advantages it offers for the duty it is called upon to perform.

A mud pump is powered by a 60-h. p. direct-current motor through a V-belt drive.

This motor is of the same type as that used for the drawworks and rotary table, but with a maximum speed of 1700 r.p.m.

The suction end is shown in Figure 2, as is also the vibrating screen over which the return mud passes before going into the ditch.

Direct-current motors are used because of their flexibility of operation, which approximates that of steam. The high starting torque which they offer has obvious advantages. They have a high efficiency under load and accelerate smoothly. Their use as prime movers for rotary drilling has been demonstrated to some extent, but the direct-current generation most economical and efficient for the type of installation here described is still subject to considerable investigation. The Diesel engine has been used by the Standard Oil Company of California to drive direct-current generators on a well in the Inglewood field, California. But that installation was not strictly comparable with this, since the drilling equipment there used was of the heavier type and required much larger motors on the drawworks, rotary table and slush pumps.

The internal combustion engine may prove most efficient for this purpose and the test will provide data of value. The engines are, of course, like automobile engines, and offer an operation and maintenance with which there is great familiarity. But the many factors of initial investment, operating costs, reliability (with the minimum of shutdown time) and life of the equipment will all have to be given due consideration.

The power plant for the direct-current generator consists of two units which are identical. They were assembled and mounted on old truck trailers which were supplied by the Union Oil Company for the purpose. Figure 3 shows them in operation at the well. Each unit consists of a gasoline engine driving a generator and exciter. The engine is a six-cylinder job with a rating of 165 h. p. at 1200 r. p. m. It is equipped with electric starting and dual ignition and was changed from standard to meet the fuel requirements. The fuel being used is a distillate of from 42 to 44 degrees A. P. I. The only other change was in the governor to comply with operating conditions.

Each generator is a D. C. generator of 250 volts, 300 amps. and 75 KW., with a speed of 1000 r. p. m. It is direct connected to the engine. The exciter is 11½ KW. and is driven by the same shaft as the generator.

The units are interconnected and can be run in parallel or separately. All power can be diverted to the drawworks motor by a control placed at the driller's position. All the controls are conveniently located at the one position. Their location with relation to the drawworks and rotary table can be seen in Figure 1. All indicating instruments, including ammeters and weight indicator, are placed most conveniently for the driller's attention, while the pushbutton controls, hand levers and foot pedals all provide the greatest facility in operation.

Although this portable drilling equipment is very adaptable to wildcat operations, it is by no means limited to such installations.

The drawworks-rotary table-prime mover assembly is suitable for all kinds of rotary drilling where the heavier type of rig is not necessary.

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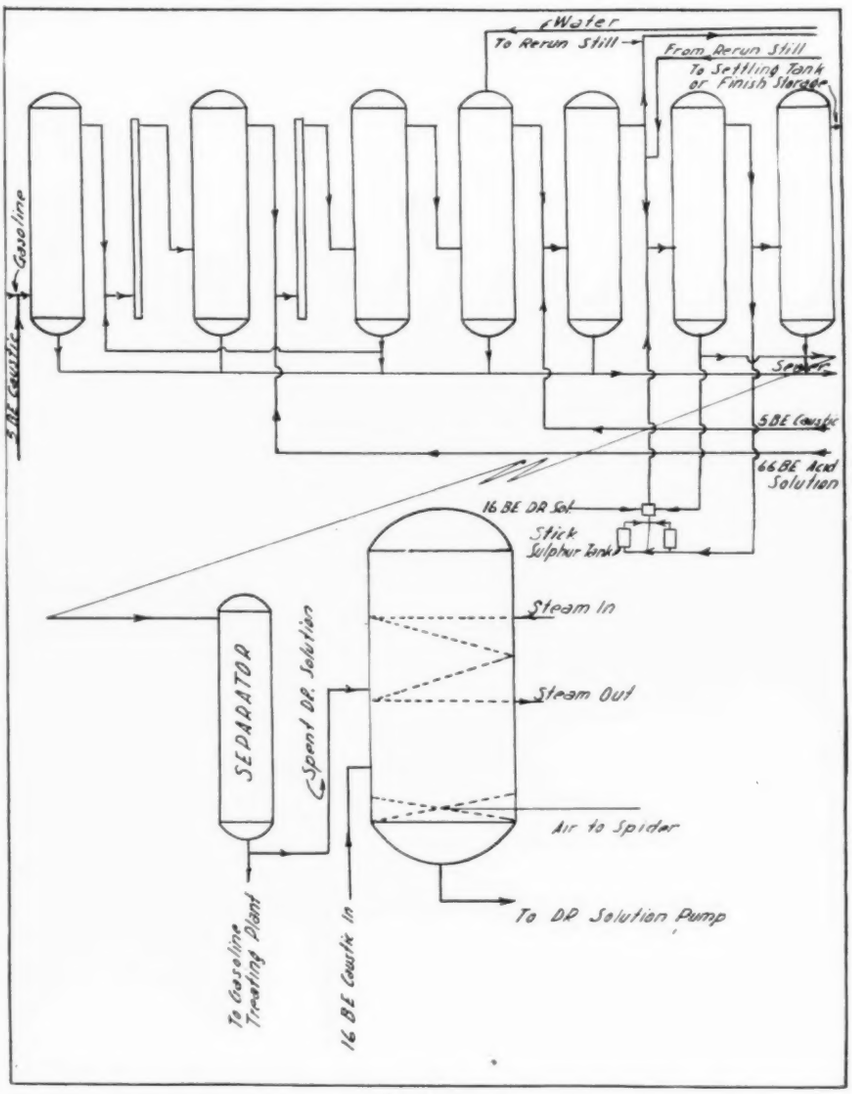
# Chemical Treatment *of* Gasoline

*By* MAXCINE J. JAPOUR, *Chief Chemist,*
*Champlin Refining Co.*

THE increasing demand for gasoline possessing a high anti-knock value has turned the attention of refiners to treating methods that would remove objectionable compounds from their products without reducing the knock rating. In discussing the chemical treatment of gasoline it is perhaps best to mention the undesirable compounds which should be removed and then to consider the various methods employed in refining. These impurities include various kinds of sulphur compound, certain unsaturated types of carbons, and those compounds known as gums and potential gum-forming constituents.

Unfortunately, due to certain specifications or regulations, it is often required to give a gasoline an unnecessary treatment to make it pass the doctor test perfectly sweet, even though it is non-corrosive and has a low sulphur content, while on the other hand the gasoline containing considerable gum-forming constituents and a maximum quantity of objectionable sulphur compounds might pass the specifications.

In this article the writer gives his observations from his experience in the treatment of various kinds of gasoline produced directly from the crude distillation or from a cracking unit.




Treating plant.

### *Hypochlorite Treatment*

The treatment of a gasoline to produce a doctor sweet product when the product does not require any other chemical treatment, but merely to satisfy certain state or individual requirements, can usually be accomplished in the easiest manner by means of the hypochlorite method. Either sodium or calcium hypochlorite can be used. These reagents can be readily repaired at the refinery, while in some plants commercial bleaching powder is preferred.

The hypochlorite solution is prepared in a tank by means of a mechanical agitator. The solution is prepared by mixing 200 pounds of caustic soda and 2500 gallons of water and saturating this solution with 150 pounds of chlorine gas; or by mixing 250 pounds of chemical lime in 5000 gallons of water and saturating with the same quantity of chlorine gas.

The treatment consists of treating the gasoline with the minimum amount of hypochlorite solution. This is agitated in a mixing head or the mixture is pumped through a baffle plate treater for intimate contact between the gasoline and the hypochlorite solution. The mixture is then allowed to settle in a tank from which the spent hypochlorite is thrown off. Gasoline is then given a water wash to free it from the chemicals. The available chlorine, which usually is about four grams per liter, sweetens the gasoline. The volume of solution required will depend upon the product treated.

The presence of certain forms of sulphur in the gasoline often makes it difficult or impractical to use the hypochlorite method in this manner. This method is not always satisfactory for treating certain cracked gasoline or pressure

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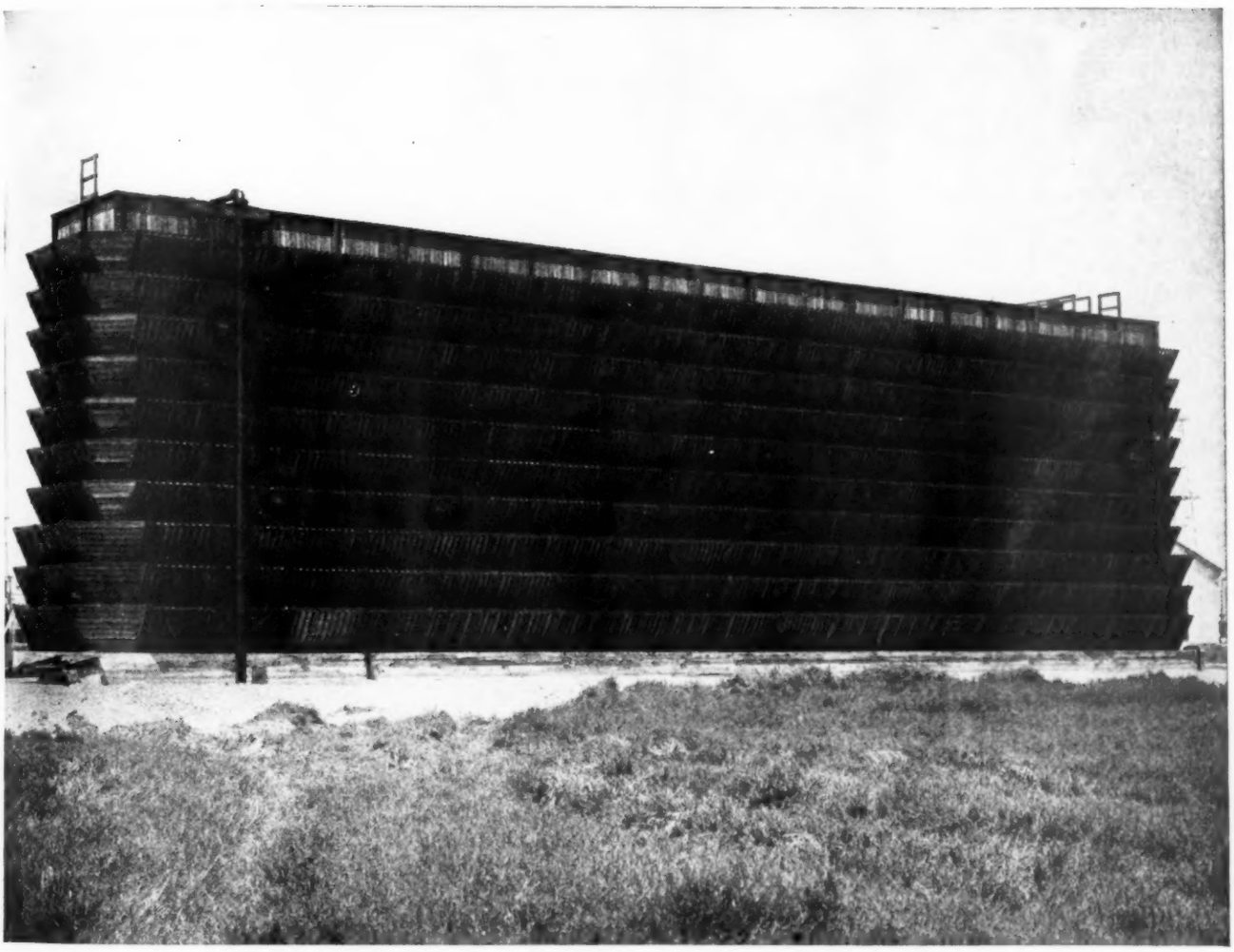

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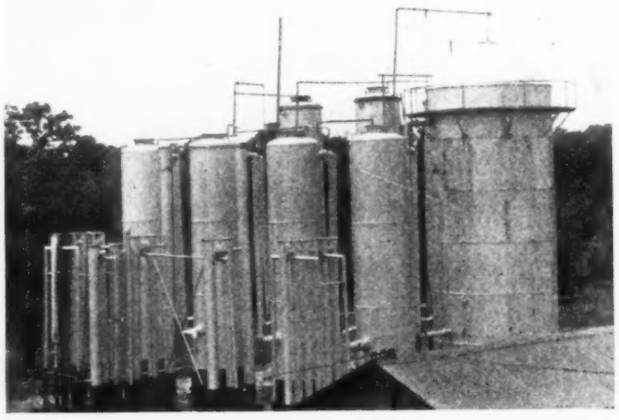
distillate, since in some cases there is a tendency toward the formation of gums.

### *Vapor Phase Treating*

The use of the Gray Tower packed with fullers earth for treating cracked gasoline in the vapor phase gives very satisfactory results. On account of the long life of the clay and the fact that its efficiency can be restored by reburning makes the installation very economical and efficient. Gums and gum-forming constituents are removed in the towers and the product is usually 30 plus Saybolt color. Usually a maximum yield can be obtained by this method, since none of the desirable constituents are destroyed.

### *Sulphuric Acid*

Sulphuric acid is extensively used for treating gasoline. It removes sulphur compounds, gum-forming constituents and unsaturated hydrocarbons. Unfortunately, this reagent also destroys some of the very desirable constituents in the gasoline, which depreciates its value as a motor fuel. This effect can be overcome to some extent by the use of a less concentrated acid than the ordinary commercial 93 per cent grade, or the treatment is carried on at a very low temperature.



Light oil treating plant, Johnson Oil Refining Company.

Very often a better yield is obtained when a weaker acid is used first, followed by a stronger concentration. Very often a partially spent or sludge acid is used for the primary treatment. In many cases when the sulphuric acid treatment is used a primary caustic soda wash is desirable to remove certain naphthenic acids or hydrogen sulphide. This tends to make the successive treatment more effective.

The practice of treating the various fractions of motor gasoline separately is becoming more prevalent. In many cases the lighter fractions require very little or no treatment to remove objectionable constituents, while the heavier fractions require more reagent. This practice very often results in considerable saving of chemicals and more efficient treatment.

### *Sodium Plumbite*

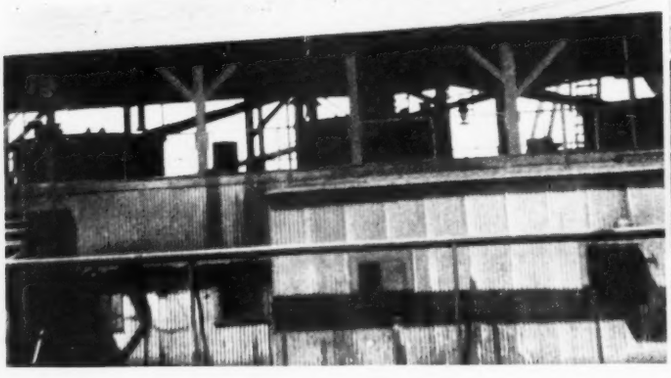
The writer has found that very often an excessive amount of flowers of sulphur are used in breaking out the plumbite by this method. This results in a product which is corrosive to the copper strip. This difficulty can often be overcome by the use of rock sulphur instead of the flowers of sulphur. The reclaiming of waste sulphides by blowing the spent sulphide solution with air in the presence of caustic soda was described by D. F. Gerstenberger in THE PETROLEUM ENGINEER, January, 1930. The continuous use of the doctor solution until spent makes the method a very desirable one.

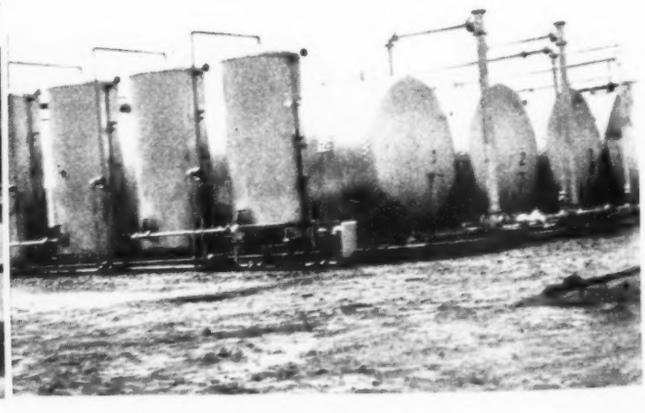
### *Hydrogenation*

A recent paper by Dr. R. T. Haslam shows the advantage of the hydrogenation process for treating distillates to reduce the sulphur content and the gum-forming constituents without the use of sulphuric acid. This method will undoubtedly solve many of the treating problems which have developed during recent years in the manufacture of high anti-knock gasoline.

At Left—Lube oil agitator and sludge fuel mixing tanks at Champlin refinery.

Below—Treating plant, Louisiana Oil Refining Company.





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# Approximating *the* Fluid Quantity Passing Through a Pipe

*By* ALEXANDER H. BASS, *Mechanical Engineer**

BERNOULLI'S THEOREM that establishes the relation between the pressures, the velocities and the positions of the particles of a liquid flowing through a tube can be expressed in the form:

$$p/w + v^2/2g + h = \text{Const.}$$

Here, p/w is evidently the pressure head. It is the height to which the liquid would rise in a piezometer tube whose upper end connects with a perfect vacuum, for p is the absolute pressure of the liquid in pounds per square foot (w=62.5 pounds). $v^2/2g$, by analogy, is called the velocity head, and h is evidently the position head, or the height of the point in the liquid filament above the assumed reference or datum plane.

Problems relating to the steady flow of liquids in which the liquids may be assumed to move in stream lines and without frictional losses can be solved by means of the equation of continuity, Av=Const., and Bernoulli's equation:

$$R/w + v^2/2g + h = \text{Const.}$$

Any discrepancies between the results computed under these assumptions and the results obtained by experiment must be corrected by numerical multipliers or coefficients determined experimentally.

Bernoulli's equation, as here written, expresses the fact that the total energy of a unit weight of the liquid remains constant. It should be understood that in this form the equation takes no account of losses due to friction, enlargements, etc., or of the energy supplied to (or withdrawn from) the liquid by pumps.

The drawing shows a pipe line starting at a reservoir so large that the discharge through the pipe does not materially lower the level of the free surface. Steady flow is assumed to exist.

The energy due to the pressure at any point of the pipe, p/w, may conveniently be written:

$$p - pa/w + pa/w$$

Here $\frac{pa}{w}$ represents the head due to atmospheric pressure and $\frac{p - pa}{w}$ the head corresponding to the gauge pressure or the height to which the liquid would rise in an open piezometer tube attached to the pipe at the point in question. As shown in the drawing, the sum of the pressure head, the velocity head, and the position head is constant and equals h+pa/w. The line joining the tops of the liquid columns in the piezometer tubes is called the hydraulic gradient. An enlargement of the pipe causes a decrease in the velocity of flow, therefore a decrease in the velocity head, and the gradient rises. The variable value of the hydraulic gradient can be recorded in a pressure gauge. If the flow were stopped by a valve at the lower end of the pipe the velocity heads would become zero, and the hydraulic gradient would become a line in the place of the extendant surface of the water in the reservoir.

If we replace the piezometer tube at A by a gauge, the reading will be

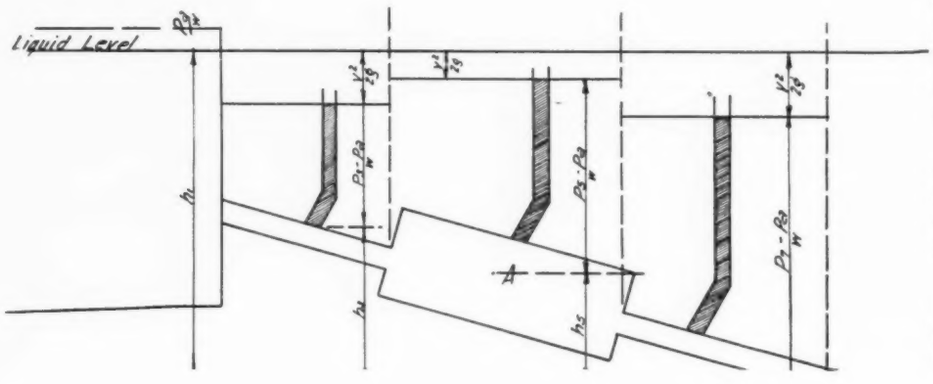
$$p - pa/w \text{ ft.} = (p - pa)/w \times w/144 = p - pa/144$$

pounds per square inch. Consider now a pipe in which a liquid flows and it is desired to determine the quantity of liquid flowing through it. If the condition permits the closing of a valve the section will be dead ended. The difference in gauge reading when fluid is passing through the pipe and when no flow exists is the change of pressure head due to the velocity head becoming zero. The gauge difference expressed in feet equals the velocity head before cessation of flow; p—pa/w=$v^2/2g$. Solving for v and multiplying by the cross-sectional area of the pipe expressed in square feet, the result is cubic feet per second passing through the pipe.

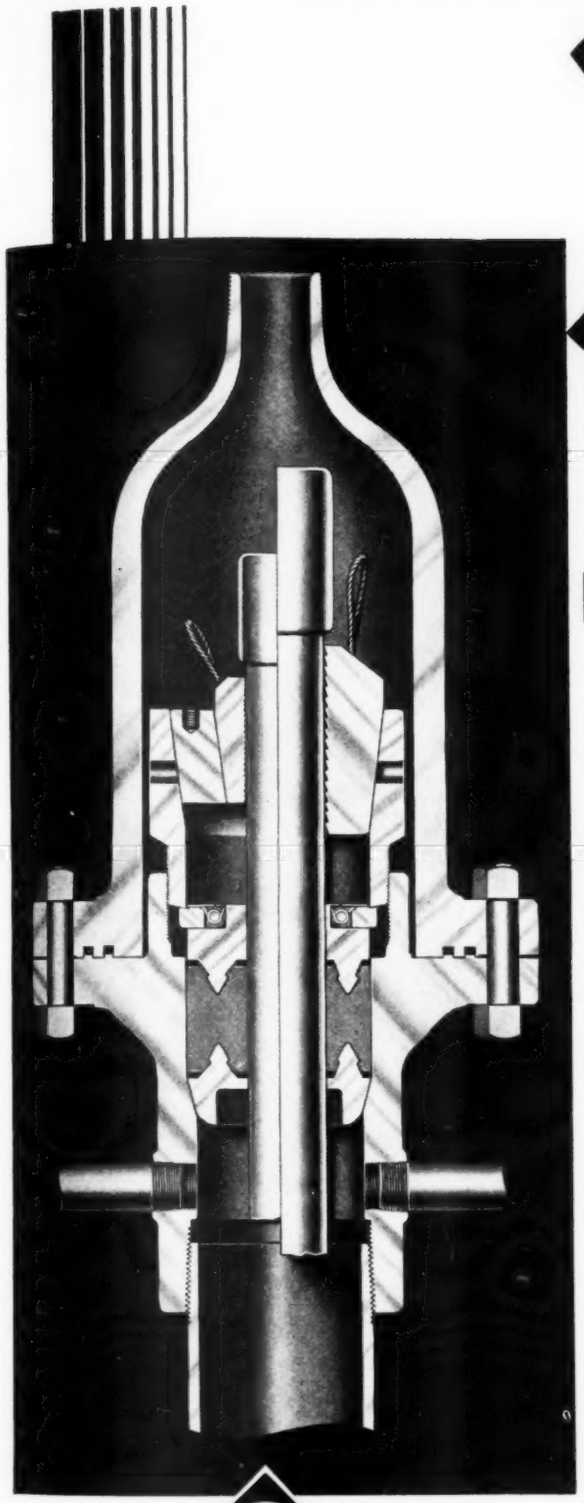
In most cases, regardless of how important the utilization of water may be, it can be arranged to shut the flow off for the brief time required for a gauge reading. It should be noted that in the above discussion no water can be supplied to or taken from the line between the source of supply and the point of measurement. If a line on which data is required is functioning as a header from which various quantities of water are drawn off, the hydraulic gradient of the whole line from the point under consideration to the source of supply will increase when the flow in the main header is shut off. Under such conditions it is necessary to first shut off all lines drawing liquid from the header between the source of supply and the point under consideration, before taking any gauge readings. After adjusting for the desired flow, the pressure head difference can be obtained from which the quantity can be calculated. If it is impractical to shut these lines off, then the increased flow through them, due to the greater pressure head in the main, can be throttled so that they pass the same quantity as they did before raising the pressure in the main.

Ingenuity is often required in selecting a method of approximating with a reasonable degree of accuracy the quantity of fluid flowing through a pipe.

The above discussion involving Bernoulli's Theorem is a special case of the general theorem of the conservation of energy.




*Sinclair Refining Company.



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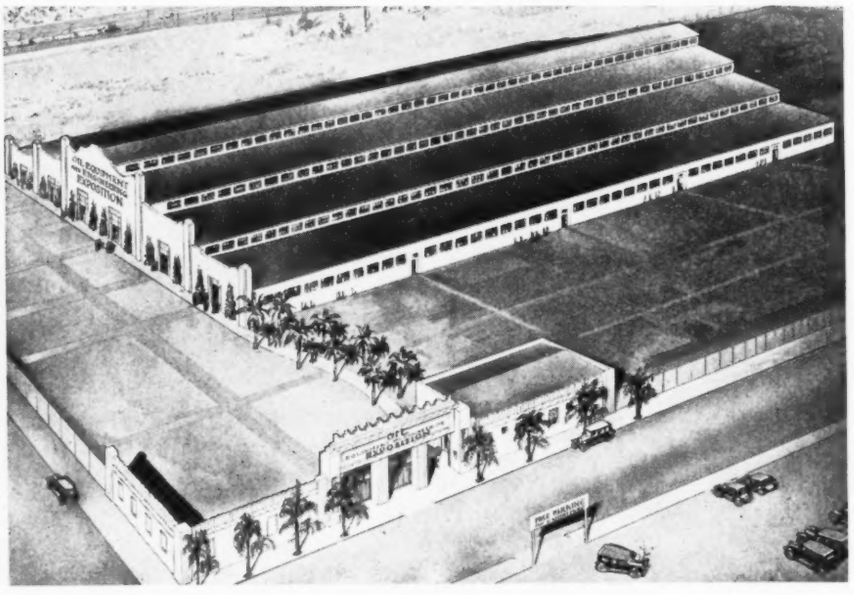
# California Show Has Exceptional Facilities



General view of the Exposition buildings and grounds.

THE new buildings which were erected by the Oil Equipment and Engineering Exposition to accommodate both the annual exposition and permanent exhibition of petroleum equipment have recently been completed. These are located at 131st Street and Alameda Boulevard, Los Angeles, and consist of the main building for the display of all types of tools and machinery, an office building for the management and an arched entrance to the grounds. An outside space of more than three acres provides ample room for derricks and heavier equipment.

All of the buildings are of white stucco and are strictly Spanish in architecture. The main building is 400 feet long by 180 feet wide, with a floor space of 72,000 square feet—about one and three-quarters acres. This is divided into 245 booths which face on six main aisles running the entire length of the building and on five cross aisles extending across the width. All the booths are 10 feet in depth, with most of them having a 20-foot frontage on the main aisles. Four corner booths are larger with a 30-foot by 10-foot area and 48 are of the smaller size with a 10-foot frontage on the aisle.

All of the exhibition space is on the one floor. The flooring is of concrete reinforced with steel mesh and with steel reinforcing rods placed on 18-inch centers. The floor thickness under the booths is four inches and under the aisles is six inches. There is no filled-in or made ground under any portion of the building and the foundation for the floor was most carefully prepared.

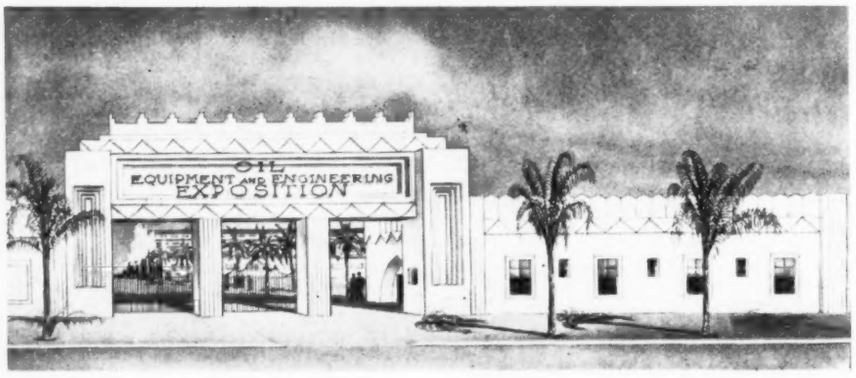
The building is finished on the inside with plastered walls. It is 26 feet in height at the center and the roof is supported by trusses with 20-foot spans. The rafters were specially cut. Four hundred skylights insure perfect light in every part of the building during the day. All the entrances are equipped with transoms that will open and thus provide a 15-foot vertical clearance.

Perfect electric lighting at night is provided with an average intensity of 11.5-foot candles by the Holophane system, which is used throughout. Provisions have been made for any extra lighting the exhibitors desire for signs, lamps, etc., with plugs on every column and in the booths. The current is 220-volt, single- or three-phase, and power is available for 75 horsepower in the front of the building and for 150 horsepower in the rear. A total of 250 horsepower is, however, available and this can be increased to meet any requirement.

Water, gas and compressed air facilities are also provided for both inside and outside exhibits. Electric current for the outside spaces can be carried to any point desired.

The office building provides a large outside office and reception room. Behind these are the offices for the personnel of the organization. The trim throughout is Philippine mahogany. The floor is of cement with acid-treated design, while the walls carry out a modernistic style.

A tennis court has been provided for the use of exhibitors.




Main entrance to the Exposition.

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# « « « The History of Bright

IN THE early days of lubricating oil manufacture, Pennsylvania refiners made a light-colored cylinder oil having a cold test of about ninety degrees Fahrenheit, the Lovibond color being 300 in half cell. This oil, known as light filtered 600, was made by steam and fire distillation; the bottoms or residual oil being afterward filtered through Fuller's earth to the light color. The stock enjoyed a good market at very fair prices and, although its high cold test made it quite unsatisfactory, it was the best steam cylinder oil to be had at the time and, so, was used wherever the service demanded the best lubricant.

McDowell Gray

Just where or when the discovery was made that wax, or petrolatum as it is now called, could be separated by settling at low temperatures is uncertain and, unfortunately, the writer does not know the name of the discoverer. However, the story is told that a manufacturer of this light-colored 600 stock started running to his stills crude that had been in storage during a very severe winter. He was surprised to find a wide variation in the cold test of the finished product and that this variation came with each new tank charged to stills. The lower cold test product was, of course, more valuable and the increase in value started the manufacturer on a search for the cause of both high (122 degrees F.) and low (60 degrees F.) cold test from the same crude charge. Investigation brought to light the fact that each tank of crude that had stood during the winter contained a bottom of several feet of a heavy waxy product which on reduction had little lubricating value. It was, in fact, mostly wax, but entirely different from the crystaline paraffine wax produced by pressing. The manufacturer proceeded at once to segregate the high and low cold test stocks and placed on the market a 60 to 65-degree cold test light filtered 600 stock.

The processing was quite simple, the method being to hold the crude in storage through the winter and as the oil temperature approached 32 degrees F. began thiefing the tank to determine the line of demarkation or the amount of waxy bottom. This thiefing was carefully watched and when the dividing line became stationary, the oil was ready for charging to stills. The top portion was decanted and charged to stills for low cold test stock production, while the bottom portion was produced from the stills as dark filtered 600 stock having a cold test of 80 degrees F. to 90 degrees F.

The new 60 to 65-degree cold test light filtered 600 stock appearing on the market at a higher price than the high cold test stock set the whole industry to thinking, and the secret was out in a very short time. The result was that many refiners turned their plants to the production of this high-priced oil, known as Bright Stock.

The name "Bright Stock" undoubtedly came from the appearance of the product, and in the writer's opinion it is certainly well named, for it is without doubt the brightest, most beautiful oil ever produced.

About 1894, or several years after this discovery, P. R. Gray, superintendent of the paraffine and lubricating depart-

The Continental Oil Co.'s refinery

# Stock Manufacture

*By* McDOWELL GRAY,
*Supt. Lubricating Dept.,*
*Continental Oil Co.*

ment of the Tidewater Oil Company, conceived the idea of taking the high cold test light filtered 600 stock, mixing it with gasoline and settling out the wax. The advantage of this operation was to obtain more bright stock per barrel of oil processed; in other words, to avoid processing the kerosene, gas oil and wax distillate fractions. The problem was turned over to the chemist, E. B. Gray, his eldest son, who, by the simple experiment of mixing oil and gasoline in varying percentages and placing a 1,000 C. C. jar of each mix on the window sill during cold weather, soon learned that the wax would settle out and that a 70 per cent gasoline-30 per cent oil mix gave the best separation. This, by the way, is accepted today as the proper mix for best dewaxing results.

This secret method was carefully guarded for a number of years, so much so in fact that the writer, another son of P. R. Gray, the seventh to be exact, when first out of preparatory school, a youth of 19 years, was put in charge of its production in order to keep the secret in the family.

Refiners of that day could keep processes secret no better than they can today, and by the year 1900 it was no secret and all refiners were using the process.

The processing by Gray's method was the same as for settling crude except that the light filtered 600 and gasoline had to be blended before going to the settling tanks. At the Bayonne plant of the Tidewater Oil Company, we used 70 degrees Be. gravity gasoline in the blend. The gasoline was pumped into the mixing tank first, and then hot (about 180 degrees F.) cylinder stock was added and the entire mass blown with air for 30 minutes. This resulted in a perfect solution of oil in gasoline of 100 to 110 degrees F. temperature. The mixture was then pumped to storage where it was allowed to settle. Just imagine, if you can, a refiner of today blowing a mixture of oil and 70 degrees Be. gravity gasoline at 100 degrees F. temperature, with air for 30 minutes. The losses were terrific and at present prices would soon ruin any company attempting to do it.

The solution was usually made up and in storage by November of each year. From two to three months of cold weather were required for the oil to reach 32 degrees F. temperature, the point at which settlement of wax seemed to stop. About one month was required to reduce the dewaxed solution and three to four weeks for distilling the petrolatum solution. As I recall, 3,000 barrels of finished bright stock was a season's work which required six months' operating time, the plant being shut down for the balance of the year.

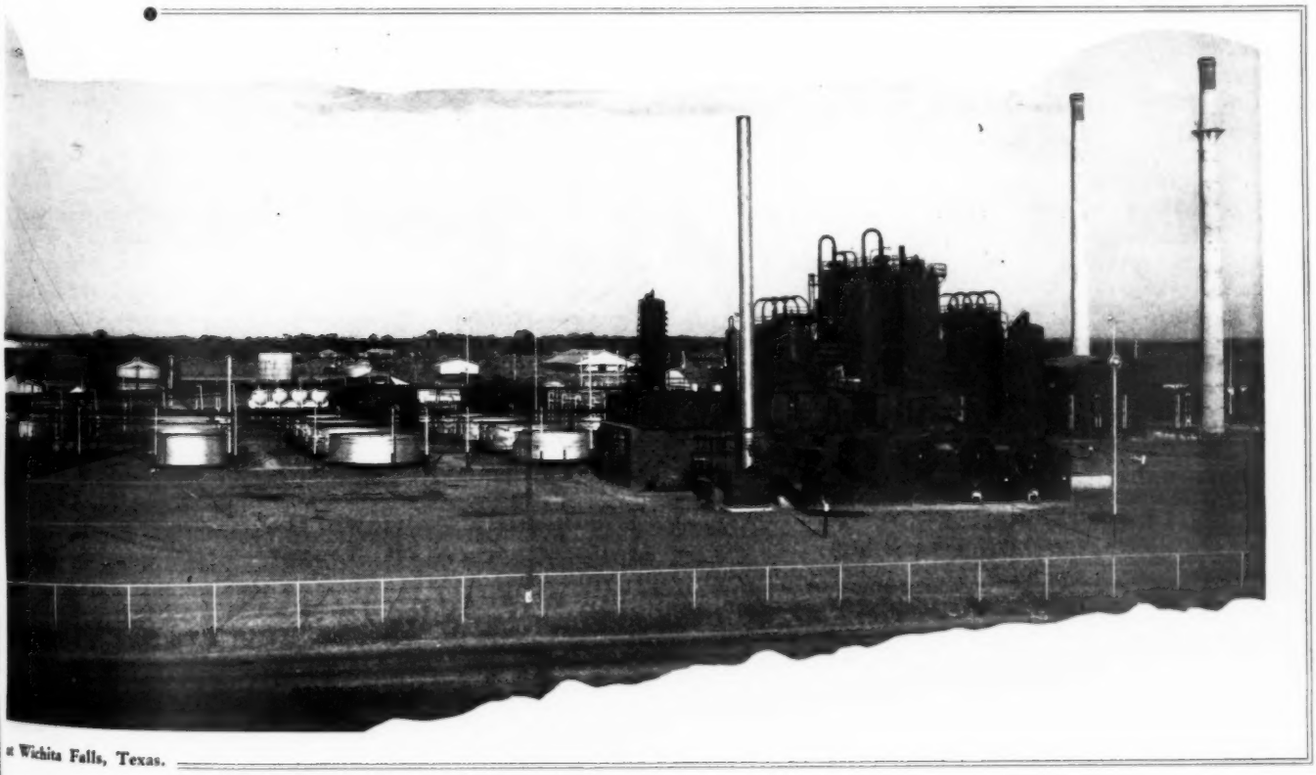
A brief description of the Tidewater Oil Company's bright stock department as it was in 1898 may prove interesting.

The mixing or blending plant consisted of two 1,000-barrel tanks equipped with air agitator coils, the perforations in the air line being so arranged that when the blow was started a stirring action was set up, giving much the same effect as one gets in stirring a cup of coffee.

The Tidewater Oil Company bought its light filtered 600 stock from the Warren Refining Company and blended it with naphtha as fast as it was received; one car of stock making a 700-barrel mix which was pumped to a 10,000-barrel storage tank.

The storage tank was filled and then came the long wait with hopes set high for an early and severe winter. It was slow, waiting for 32 degrees F. temperature with a regular daily thiefing to see how the wax was settling.

Sometimes after a nice long cold spell with everything looking just right for a successful year, the weather would turn warm quite suddenly. This would, of course, cause the solution to warm, which would set the starting date



at Wichita Falls, Texas.

back and if of too long duration, would ruin the season's work.

Sometimes the weather would become entirely too cold and would freeze the oil so that it would not settle at all and once in a long time a mild warm winter would ruin everything; the solution never reaching the proper settling temperature.

However, absolute failure was of rare occurrence and at last came the day, usually in early February, when thiefing showed the wax settlement to be complete, the solution above the wax line being perfectly bright and at 32 degrees F. temperature.

The swing line in the solution storage tank had at the start been set at a point twelve inches above where we expected to find the wax line and when this wax line became stationary, the swing line was either raised or lowered as needed. The oil was then allowed to settle two or three days more to allow any wax that might have been stirred up by moving the swing line to settle out and was then charged to a steam still at the rate of 200 barrels per day, which gave a yield of about 60 barrels of bright stock.

Reduction to 540 flash by steam distillation was a very slow process. It usually took 14 to 16 hours to make a run. However, one run daily was required of us in order that all of the settled oil could be reduced to bright stock before warm weather had a chance to raise the tank temperature, as any raise in tank temperature of the settled solution would tend to raise the cold test of the finished oil.

After reduction the bright stock was pumped to a steam jacketed tank where it was heated to about 180 degrees F. temperature and decolorized with 60/90 mesh Fuller's earth. The treatment was to restore color loss due to processing and to produce bright stock of a 300 Lovibond color in a half-inch cell, or the same color as the light filtered 600 stock.

After treatment, the clay was separated first in an ordinary 36-inch wax distillate filter press, then in an 18-inch Johnson square cast iron press, which press removed the very fine clay and gave a bright stock free from sediment.

It will be noted from the description of the Tidewater plant of 1898 that the present-day method of processing cylinder stock to a finished bright stock differs but slightly from the methods used more than 30 years ago.

The change from natural to artificial refrigeration was the next step and this was started early in 1900. I do not know positively who operated the first cold settling plant using artificial refrigeration, but this honor I believe to be held by one of three refineries: The Vacuum Oil Company at its Bayonne plant, the Standard Oil Company of New Jersey at its Bayonne plant, or the Atlantic Refining Company at Philadelphia. All of these companies were evidently at work on the problem at the same time. The Atlantic Refining Company's plant was the first one that I saw in operation, but I am inclined to believe that the Vacuum Oil Company was the first to produce bright stock by use of artificial refrigeration.

The first cold settling tanks were long, shallow pans about two feet deep, ten feet wide and forty feet long, having brine coils in the bottom. This was the usual type, although I believe the Atlantic Refining Company's pans were four or five feet deep. From the shallow rectangular pan, the refiners turned to the upright cylindrical tank of from 10 to 15 feet in diameter and 20 feet high. The first tanks of this type used as settlers had double jackets with brine space between shells.

The jacketed tank was very soon supplanted by single shell tanks with cooling coils located near the top of the oil level, this type tank enabling operators to turn a batch in from 72 to 96 hours. The addition of a second, and after a few years, a third coil, cut the cycle to 45 to 60 hours and slightly improved the cold test. Fifty to 55 degrees F. cold test could be made quite consistently by the use of artificial refrigeration, as compared to 60 to 70 degrees F. by the crude oil tank settling method, and in later years, 40 to 45 degrees cold test was obtained by the cold settling method. This improvement was brought about by the addition of cooling coils to the point where as high as seven or eight coils were used, with an increase in efficiency and an improvement in fractionation that enabled the refiner to make a complete cycle in from 36 to 42 hours, to turn out cold test material of 40 to 45 degrees F. and to divide the settled bottoms into two cuts, one from 70 to 90 degrees F. cold test, which was suitable for resettling and the extreme bottom which made a fairly high melting point petrolatum.

Troubles were plentiful as is always the case with new processing methods and then, even as now, there were batches of oil from which the wax would not settle. Many expedients were used to make the wax settle. One that I particularly remember hearing about was where four boilermakers pounded on the sides of the settling tank with hammers for ten hours in an endeavor to shake the wax loose. However, a batch that was wrong never could, as far as I could learn, be made to drop its wax—and many such batches were made.

Cold settling was entirely too slow to meet the large and increasing demand for low cold test bright stock and a search for a faster, more positive method of separation led to the use of centrifugal force.

A number of refiners were at this time experimenting with cream separators. In fact, as early as the summer of 1896, the writer cranked a cream separator all day long for days at a time, trying to remove wax from oil. But it remained for P. T. Sharpless to solve the problem.

Mr. Sharpless, a manufacturer of cream separators; H. M. Nichols, superintendent of the paraffine works of the Atlantic Refining Company, and L. S. Delbridge, assistant to Nichols, all close personal friends, decided after much discussion that the cream separator did not have sufficient speed to develop the centrifugal force required to cause separation. Mr. Sharpless then designed a high-speed centrifuge with a four-inch bowl and assigned a Mr. Jones to work on the problem at the Atlantic Company's refinery. This took place in the year 1915-1916.

Jones worked on the problem for many months and, while he was able to get separation of a sort, he was unable to make the petrolatum discharge from the bowls.

Another discussion by the same three men brought out the idea of a liquid carrier, calcium chloride brine, to float out the wax. By this time the method had shown so much promise that the Sharpless company built a small but very complete dewaxing plant which, by the use of a cold calcium chloride carrier, liquid introduced at the bottom of the centrifuge bowl mixed with the oil-naphtha solution, brought the process to a state of perfection that warranted the building of commercial units.

Six refining companies: The Penzoil Company, the Texas Company, the Kendall Refining Company, the Mutual Oil Company, the Marland Refining Company (now the Continental Oil Company) and the Midwest Refining Company, all purchased units at about the same time. Sharpless then discontinued the sale of equipment until some of these plants were in operation.

Kendall Refining Company beat the field and early in 1921 introduced the first bright stock produced by centrifugal machines in commercial quantities.

The preparation of oils for centrifuging differed but slightly from the methods used in cold settling plant, but after the oil-naphtha mix was made, the oil for centrifuging

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# WAUKESHA ENGINES

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had to be kept in motion to avoid settling of the wax.

The cooling was done in tanks equipped with brine coils and having a stirring mechanism at the bottom to prevent wax settlement. At first the oil was cooled in batches and entirely by artificial refrigeration. Then came a two-stage cooling system, the first stage using cold dewaxed oil as a cooling medium which lowered the oil temperature from 100 degrees F. to about 45 degrees F. This preliminary cooling was done in batches and in a tank equipped with coils and stirring device, the same as the brine-cooled tanks. As soon as the oil was cooled as low as possible with dewaxed oil, it was transferred to a brine-cooled tank where temperature was reduced to that required for centrifuging, usually ten degrees below zero at which temperature it was charged to the centrifuge machines.

This method of cooling required very complicated pipe systems both for oils and brine and entailed a loss of recoverable refrigeration as the dewaxed solution would reach storage tanks at 40 degrees F., whereas with a well-designed continuous cooling system, the dewaxed oil could be raised to 80 degrees F. before going to storage, thereby recovering considerable more refrigeration.

The bright stock produced at this time was not a satisfactory product, due to its being very cloudy at fairly high temperatures (60 to 70 degrees F.). It was good low cold test (20 to 25 degrees F.) stock, but it could hardly be called bright stock. This cloud was due to slight traces of calcium left in the oil by the carrier liquid. It was practically impossible to remove it, nor was the process a complete commercial success until the use of the calcium chloride carrier liquid was discontinued, late in 1921.

In discarding the carrier liquid, it was necessary to provide some means of melting the petrolatum as it was discharged from the bowls so that it would flow away from the machine outlets and on to the run tanks.

The Midwest Refining Company accomplished this by use of hot calcium chloride solution introduced at the top of the bowl. The hot brine was sprayed against the petrolatum outlets, and melted the petrolatum as fast as it discharged from the bowl, in which condition it would easily flow away from the machines.

This change solved one of the big problems of successful centrifuging, but the calcium cloud still remained and corrosion of bowls and bowl necks became a serious maintenance problem.

In the fall of 1921, Walter Miller, general manager of the Marland Refining Company, now Continental Oil Company, proposed using hot water to melt the petrolatum instead of hot brine. His proposal met with objections from everyone. It was thought impractical. The water would enter the bowls and freeze. These objections did not stop Mr. Miller, however, and after having had special bowl covers made, he started a test run. Much to everyone's surprise, it worked perfectly. The problem of cloudy bright stock was solved and bowl corrosion practically ceased.

This took place in December, 1921, and I feel perfectly safe in saying that the first really bright Bright Stock manufactured by centrifuge machines was produced by the Marland Refining Company (now Continental Oil Company) at that time.

The next change in processing methods was the step from batch to continuous cooling of the solution. This was also developed by the Marland Refining Company and was done on a commercial scale in the fall of 1926.

Up to this date everyone was satisfied with a 20 to 25 degree cold test bright stock and it was considered by many authorities to be practically impossible to produce commercially a bright stock of a lower cold test, but when the use of aeroplanes created a demand for a very low cold test lubricating oil of high viscosity, the refining industry as usual produced the oil required; namely, bright stock of a zero cold test.

The Texas Pacific Coal and Oil Company, under the leadership of Dr. E. R. Lederer, was first on the market with a zero cold test bright stock, which stock was offered for sale in the fall of 1927.

This unusual stock appearing on the market as it did without notice and in the face of opinions of many able men that such a stock could not be produced, caused a real flurry in the industry.

Max B. Miller & Company at once brought out a new type continuous chilling tank, using direct expansion ammonia as a cooling medium. The ice machine manufacturer supplied machines that would produce the very low temperatures required (60 degrees F. below zero) for making the zero cold test stocks economically. And right now a large proportion of bright stock manufacturers are making either the low cold test stock or getting ready to do so.

The processing to zero cold test is one requiring most careful supervision at each and every step and it is not, as many people think, just a case of lower centrifuging temperature. The base or steam refined stock must be very carefully made and the treating, contacting and even blending with naphtha, all have some effect on the ultimate cold test and if it is desired to reach zero cold test, the oils must be handled with much care and attention.

Zero cold test paraffine base lubricating oil is no longer a dream. It is now a fact. It is on the market and has been offered for sale by many manufacturers over the past year. All of which means that in a very short time practically all refiners of lubricating oils will produce the zero cold test grade.

It is difficult, at this time, to conceive of any further progress or great changes in bright stock manufacturing processes. Zero cold test is certainly all that will be required by the trade for some years to come, but those who have seen the rapid development of crude oil refining processes over the past six or seven years, know that what appears at this time to be a perfect product will soon be supplanted by something newer and better.

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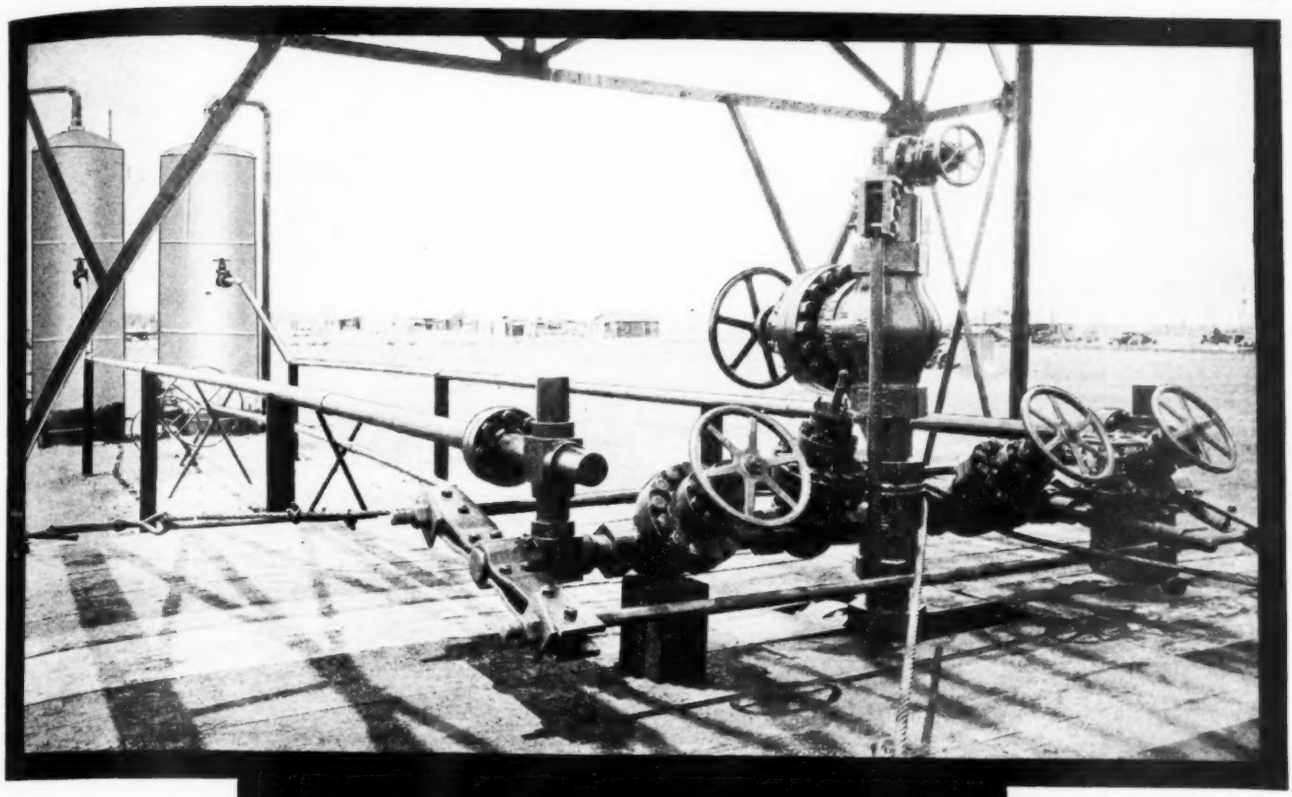
## Well's Water Production Reduced by Tubing

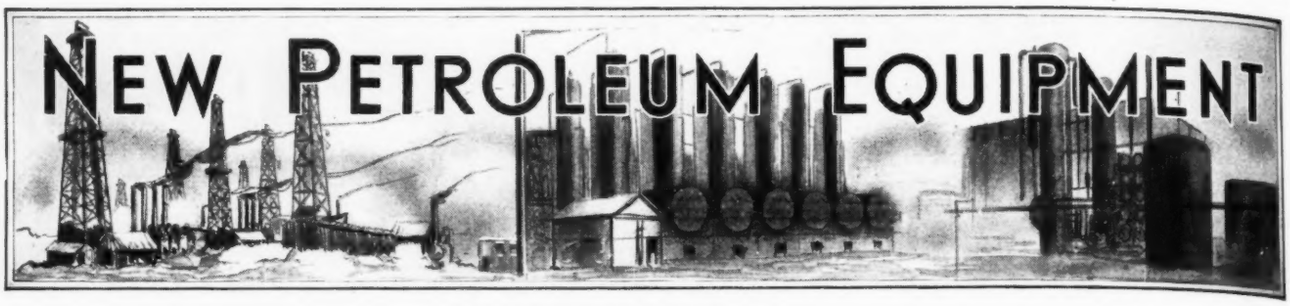
THE tubing of a well producing from the lime formation in the Oklahoma City field resulted in a material reduction of its water output.

Indian Territory Illuminating Oil Company's Canfield-Button No. 3 was tubed under pressure with three-inch tubing set at 6,000 feet. Before being tubed, the well had been making 7,300 barrels of oil and 720 barrels of water, or approximately 10 per cent.

The first 16-hour test after tubing the well flowed at the rate of 3,800 barrels per day. At the beginning of this test it was making 30 per cent water, and at the end of the period it was making 20 per cent water.

The next 12 hours the well flowed 3,600 barrels, with its water output down to seven and one-half per cent. A one-inch choke was installed for the next 12-hour test, and the back pressure was gradually increased to 500 pounds in the tubing. The well made 3,500 barrels and was making only two and one-half per cent water.






## Link-Belt Vibrating Screen

LINK-BELT COMPANY a short time ago placed on the market vibrating screens, which are used on drilling wells to separate the cuttings or shale from the rotary drilling mud.

At Hobbs, a number of the company's standard No. 145 vibrating screens are in use. They are especially desirable at Hobbs due to the character of the soil. The screens are also used to salvage mud after the completing of wells. This is a very important item at Hobbs because of the mud expense.

Approximately 900 gallons of fluid are being handled per minute by the Hobbs installation. This fluid, a combination of mud and water, weighs approximately nine pounds per gallon up to a depth of 1,500 feet, when the mud is increased as the hole deepens to 15 pounds per gallon. The running load of the machine is .97 horse power, but the starting torque requires approximately 1½ horse power. At present, the power used on the screen in operation is supplied by the turbine half of a Pyle Rig Lighter. This turbine drives the screen at 1,800 r.p.m. by means of a double V belt drive.

Perhaps the most important work of the screens, from the standpoint of the operators, is the salvaging of old mud. At Hobbs this has been a big saving, because most of the mud must be bought. After salvaging the good mud from an old pit it is moved to the site of a drilling well and reused.

Where screens are used at Hobbs, the digging of one of the two slush ponds has been eliminated. The digging of these slush ponds at Hobbs is very expensive, since there is a six-inch layer of rock on the surface.

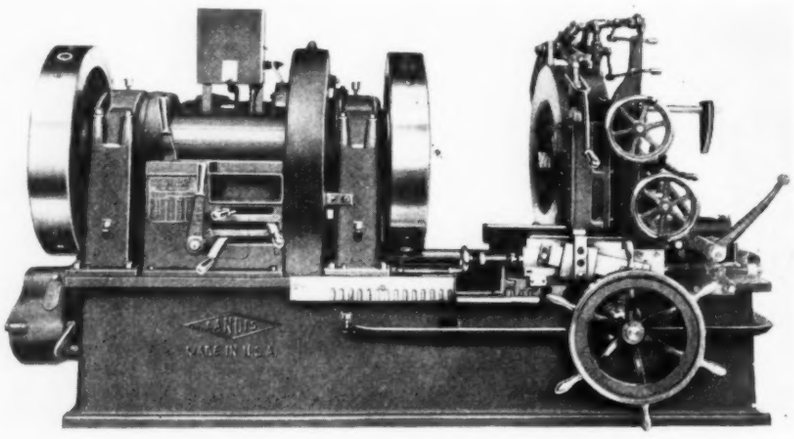
## New Eight-Inch Landis Pipe Machine

THE Landis Machine Company, Inc., at Waynesboro, Pa., has developed a pipe threading and cutting machine with a receding chaser two-cut die head and leadscrew attachment. The receding chaser feature makes possible the cutting of long lengths of tapered threads with narrower chasers, and increases the life of the chasers. A chaser 1-15/16-inch in width is employed regardless of the total thread length.

This chaser has a combination turning and threading throat. The scale and surplus stock are removed by the turning section of the throat. The same chasers can be used for any pipe size within the range of the die head, as long as the pitch, taper and thread form remain the same.

The die head is a two-cut head, permitting roughing and finishing cuts without change of the diametrical adjustment. Both the roughing and finishing cuts are controlled by the one taper mechanism. Equal distribution of the cut is given by an independent adjustment from the chasers. The chaser holders are gibbed and are actuated by the cam ring and tapered rollers mounted on ball bearings.

The taper mechanism generates a straight line taper or a taper that is uniform throughout the entire thread length. The sine bar is easily and quickly adjusted for all tapers up to and including ¾-inch taper per foot. A plug provides a positive means of locating the sine bar for ⅛, ⅜ and ¾-inch tapers per foot. Provision is made for taking up the lost motion which may develop in time from wear. Further particulars of this new machine may be had from the Landis Machine Company.



# Rotary Drill Collars

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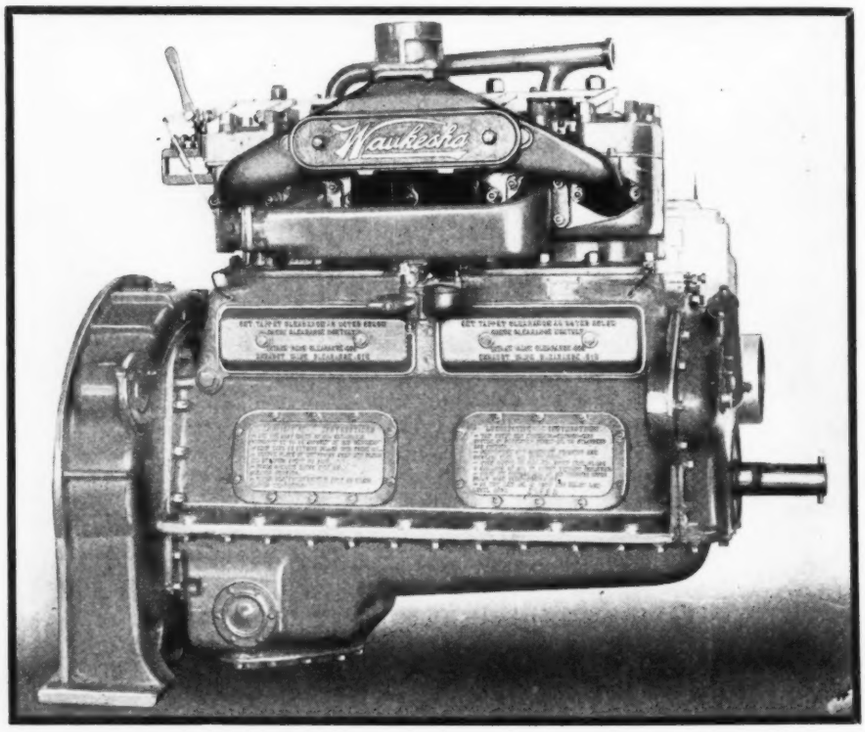
## Waukesha Has New Power Plants

THE Waukesha Motor Company of Waukesha, Wis., has introduced several new sizes and types of power plants, including two new Diesels. The larger of which is a 225-250 horsepower six-cylinder engine operated at 900 to 1050 revolutions per minute. The smaller is a four-cylinder engine rated at 90-100 horse power and operated at 950-1000 revolutions per minute.




Special features common to both these engines are: (1) Ease of installation. They can be fitted into the same space with the same clutches and drives as their gasoline counterparts. (2) Easy starting by a special gasoline starting system. (3) Non-clogging injector tips. (4) Ell head design with controlled turbulence.

The largest six-cylinder engine built by this company has also been introduced. It is rated at 325 - 350 horse power at 1000-1100 r.p.m. It is fitted with Waukesha Gaspower Mixer — a gas carburetor that affords close regulation under varying loads and speeds and operates on very low gas pressures. The engine is an overhead valve unit with replaceable sleeve cylinders, seven-bearing crankshaft and built-in compressed air starting system.

## Lucey Fully Enclosed Oil Bath Rotary

THE new Type A-14000 fully-enclosed oil bath rotary of the Lucey Products Corporation is designed to provide a continuous bath of oil for all bearings and moving parts.

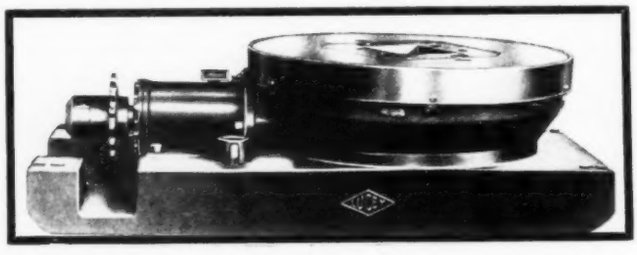
The table and base are electric cast steel, electrically annealed. The outside diameter of the table is 58¾ inches, while the largest opening through it is 26 inches. The base is of one-piece unit construction, of which the box type skids are an integral part. An annular steel ring is mounted on the base, completely shrouding the outer diameter of the table. This is to guard against injury to the table and adds safety for the operator. The table bearings are large-diameter alloy forged steel cones, hardened and ground to gauge. Cones run in heat-treated alloy steel race rings are removable from both the base and table and interchangeable.

The lower hold-down ring is of two-piece construction—the thrust ring and the adjusting nut. The thrust ring is keyed in place on the lower protrusion of the table, and has its bearing on the machined and ground face of the base. The adjusting nut is an annular ring threaded to fit the lower protrusion of the table.

The thrust ring runs in a bath of oil which reduces wear and friction to a minimum, and, in combination with a felt insert in the machined face of the base, forms a seal against the entrance of foreign matter as well as the loss of lubricant.

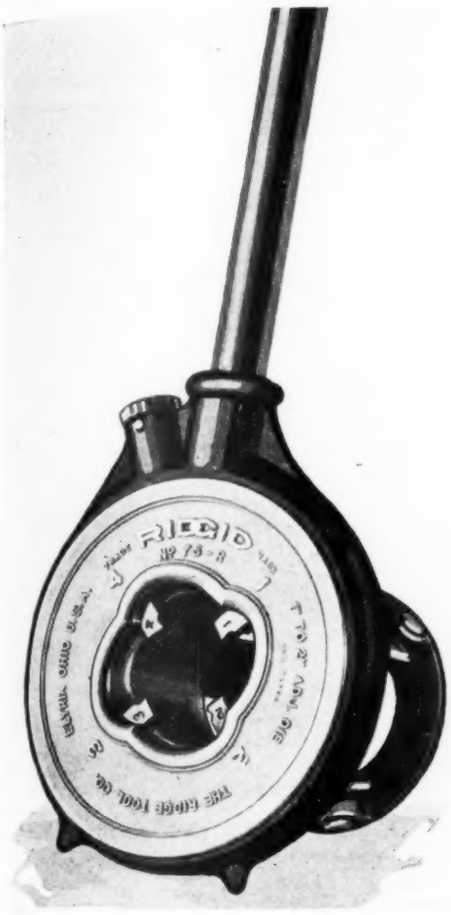
Another feature of the rotary is the double radial bearing for absorbing side thrusts of the machine when drilling. These radial bearings are so placed that one is above and the other is below the main bearing of the rotary. The upper radial and lower radial bearing have a combined bearing surface of more than 1,050 square inches.

The pinion shaft is an alloy steel forging, six inches in diameter, machined and heat treated. Pinion shaft bearings are self-aligning roller type mounted in electric steel cast, electrically-annealed bearing boxes of unit construction. The bearing boxes are adjustable with respect to the pitch line of ring gear and pinion. The pinion shaft is positively locked from turning in either direction by throwing a single lever. This lever is located on the opposite side of the rotary from the driller, and does not interfere with stacking drill pipe. A locking device is also provided which permits the master bushing to be locked in the rotary table and prevents slips being set in if the master bushing is unlocked.



Over-all length of base is 106½ inches; width of base, 48 inches; height over all, 29 inches; height above skids, 18 inches; net weight, 11,545 pounds.

## New Ridgid Die Stock



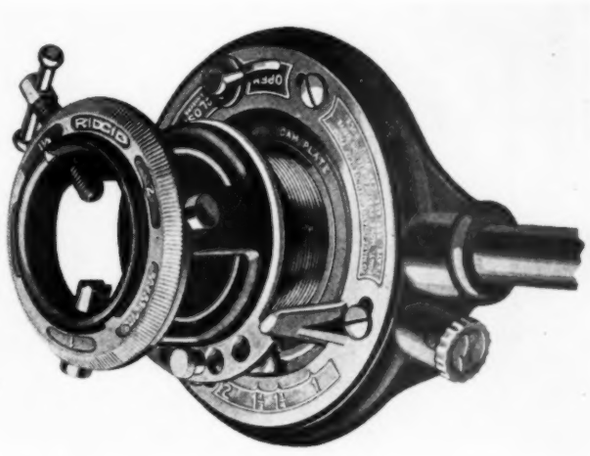
THE Ridge Tool Company of Elyria, Ohio, has placed on the market a new Ridgid die stock. The new die stock offers a new type of chasers, in which one set cuts four sizes of pipe.

These chasers are of new design and cut like a lathe tool, straight on the face with only the cutting edge in contact with the pipe. The setting of the chasers for different diameters of pipe is mechanical and accurately perfected. No tools are needed for this work. The setting can be done with work holder on lead screw in any position.

A thumb lever opens the chasers for backing off, saving wear and chipping, and lengthening the life of the chasers.

An entirely new type enclosed centering device of the die stock has knurled dial on work holder which is twisted until the arrow points to size of pipe to be threaded, at which time it clicks into place. An arrow on the ratchet pawl indicates the direction of cutting.

Full details of this new Ridgid die stock may be obtained from the Ridge Tool Company headquarters or any of its representatives and branch offices.




## New Guiberson Duplex Catcher

AN outgrowth of the Guiberson Catcher is the new Guiberson Duplex Tubing Catcher, which has been developed to meet the safety requirements of tubing in deep wells. It is designed with a multiple of slips, one set above another, the slips operating in unison and actuated by common means.

When the Guiberson Duplex Catcher is used, the shock occasioned by the fall of a string of tubing is effectually distributed over a much greater area of the casing circumference, thereby reducing the possibility of distortion to the casing.

## Automatic Control Type Indicator

THE Brown Instrument Company of Philadelphia, Pa., has designed a new automatic control type indicator that can be used as an automatic control pyrometer, resistance thermometer, tachometer, or $CO_2$ meter.

It offers reading observations directly on six-inch scale, index on scale for setting to exact control point, control point instantly and easily adjustable, all wiring terminals and motor enclosed, Mercury switches up to 30 amperes capacity, suitable for "on and off" or "three-position" control, available safety device which opens furnace circuit if thermocouple or wiring fails, high internal resistance, automatic internal compensation eliminating cold junction errors, and simplicity and ruggedness, state the manufacturers.

## New Petol Chain Tongs

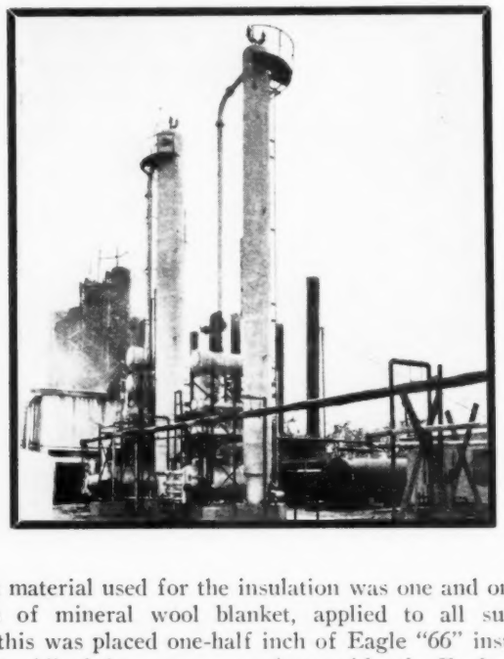
THE GEARENCH MANUFACTURING COMPANY, Houston, Texas, is now making deliveries on Petol Chain Tongs, a tool of entirely new design incorporating a number of unusual features.

When applied, the chain makes a full wrap around the work, developing a friction hold of even pressure at all points. It is said to eliminate pipe crushing and damages to nipples and fittings.

It has a positive release. Regardless of the pressure applied on the handle, the tong cannot be jammed or frozen on the work, according to the manufacturers. A slight lift on the handle releases its grip instantly.

## Eagle-Picher Insulation at Cyril

THE L-M UTILITIES COMPANY, of Tulsa, Okla., distributors in Oklahoma and Kansas for the Eagle-Picher Lead Company of Joplin, Mo., some time ago insulated completely the equipment furnished The Anderson Pritchard Oil Corporation for its plant at Cyril, Oklahoma, by Petroleum Engineering, Inc., of Tulsa.



The material used for the insulation was one and one-half inches of mineral wool blanket, applied to all surfaces. Over this was placed one-half inch of Eagle "66" insulation cement. All of these were manufactured by the Eagle-Picher Lead Company and sold by the L-M Utilities Company.

After insulating as above, the entire surface was covered with canvas and painted with guaranteed waterproof paint, then sprayed with aluminum paint.

It is claimed by the insulators that this material gives a saving of 93.91 per cent of the heat losses when operating at 400 degrees F.

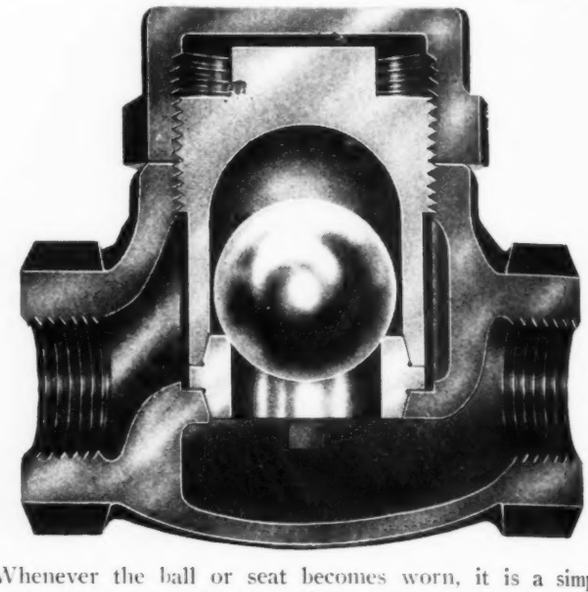
The L-M Utilities Company has been in the insulating business for the past year. Complete warehouse stocks of materials are carried at Tulsa, Okla.

## A New Check Valve

A NEW check valve that can be installed on any line, handling any fluid, is now manufactured and marketed by the Oil Field Engineering Corporation of Fort Worth.

This valve, called the Bal-Re-Nu, has been patented by C. S. Jones and J. A. Leidecker of Tulsa.

The construction of the valve is an adaptation of the familiar oil-filled ball and seat to a valve installation.

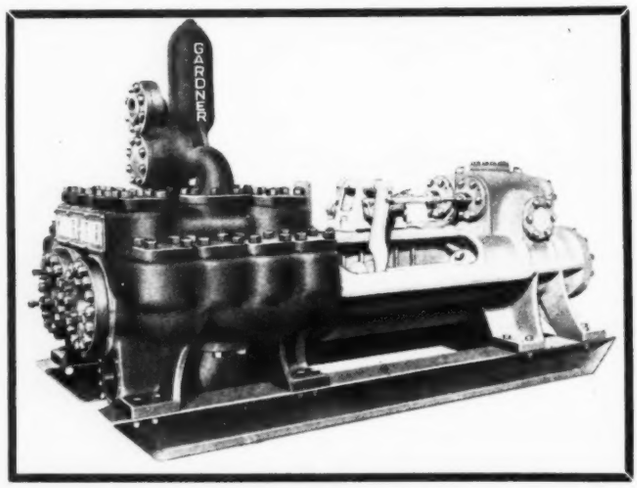


Whenever the ball or seat becomes worn, it is a simple matter to unscrew the top and cage, remove the worn parts and substitute new ones.

## New Universal Pitman

A NEW type of universal pitman equipped with roller bearings is now being manufactured by the Axelson Manufacturing Company, Ltd. Taking the place of the plain fabric bearings formerly used in the wrist pin housing on the piston, tapered roller bearings are utilized and arranged in a spherical housing.

The entire pitman is easy to install and detach. The anti-friction bearings are packed in grease at the factory and require little lubrication. Dirt and foreign matter are kept out of the bearings, since they are completely enclosed.

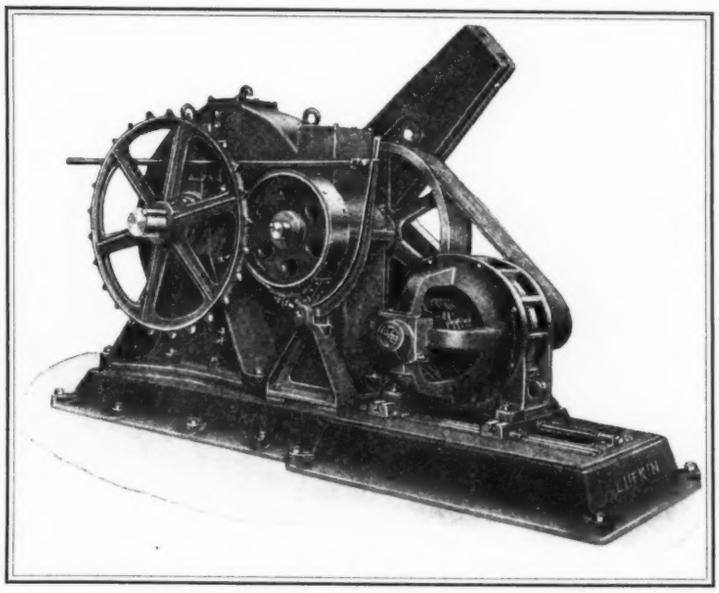



## New Sixteen Valve Mud Pump

THE GARDNER-DENVER COMPANY has introduced a sixteen-valve 16 by 8 by 24 Mud Pump. The new valves are light weight, with large passage area, rubber insert, and steel seat. All valve posts and passages are circular in section. The change from eight large heavy valves to sixteen small light weight valves, according to the manufacturer, reduces the violent impact due to valves closing when pump is in operation.

Each valve is located in a separate chamber with independent fluid passages, eliminating wash-over of mud from one valve to another. Steam cylinders and cradle are cast integral in perfect alignment. The cylinders are designed for 350 pounds pressure.

The new mud pump has a divided fluid end — two separate castings, with no internal baffles or walls. The guaranteed working pressure is 1500 pounds, but a shop test of 3000 pounds hydrostatic pressure is given each pump.



## New Sykes-Herringbone Unit

THE LUFKIN FOUNDRY & MACHINE COMPANY, Lufkin, Texas, is marketing a new Sykes-Herringbone Unit for pumping, pulling and drilling.

The gears used in this unit are of the Sykes-Herringbone type, which are heavily constructed, superior strength and are silent in operation. Freedom from back-lash, continuity of tooth contact and maximum tooth surface for width of gear face are features of the gears.

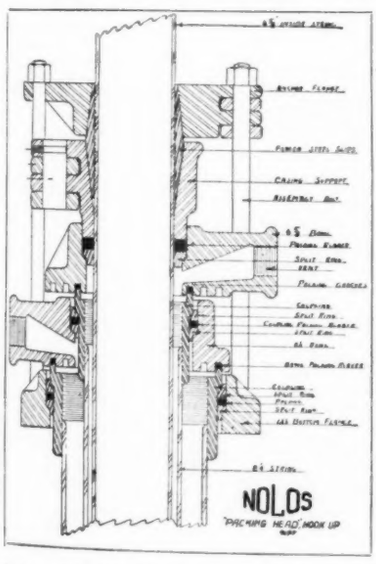
The unit is easily adapted to any type drive and particularly to single-cylinder gas engines. This unit has the right "fall" for cable tool drilling. Recently a record for cable tool drilling was made by one of the large oil companies while drilling with the Sykes-Herringbone unit. The gears are made of a special alloy steel, heat treated, are generated on a special machine for the purpose and are then ground to precision with ground glass and oil on a special "lapping-in" machine. This process gives absolute matching of gear and pinion with a resulting smoothness and silence in operation.

The machine is constructed heavily throughout and is built for long, lasting, continuous service.

## Absorption Oil Reclamation Still

A NEW absorption oil reclamation still has been developed by the Union Oil Company of California, under the direction of Clare Gard and is now being marketed by The Trumble Gas Trap Company of Los Angeles. This still serves the purpose of cleaning up the absorption oil and keeping it clean so that efficiency may be obtained.

## New Features in O. W. I. Packing Head




THE Oil Well Improvements Company is now making a new packing head featuring packed slip joints and is held by eight 1½-inch bolts.

This packing head anchors each string of casing against end movement either up or down. The various bowl sections are progressively interchangeable. That is, any size bowl will fit directly upon any larger size bowl, thus five-inch can fit directly over ten-inch or 12½-inch casing without the necessity of intermediate spools, and having the advantage of minimum height.

Each bowl section may be used interchangeable as a packing head against the collar or a braden head against the pipe.

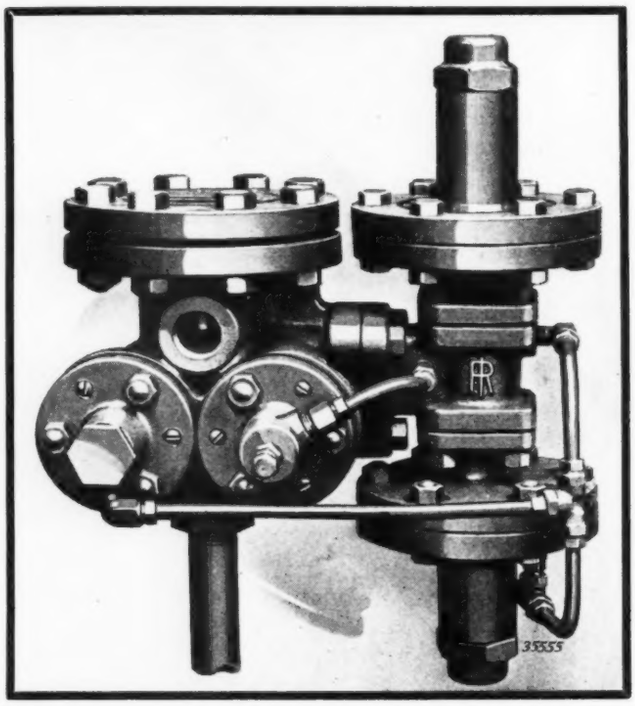
The inside string of casing is held in place by double acting slips in a hinged bowl. The upper movement of the pipe is prevented by hinged anchor flange conforming to the slips.

## Spang & Company New Products

SPANG & COMPANY, of Butler, Pa., has introduced some new fishing tools, among which is a grab of novel mechanical construction. In this device, the leverage action of the movable tooth jaws insures a very definite hold on such broken or detached tools as it is possible to fish from a well with a grab. The grab is also being produced for use on rotary equipment and is provided with means for water circulation.

This company has also designed a new trip casing ripper for splitting the casing out of a coupling. It has a joint connection at either end, and may be reversed for the purpose of ripping in an upward direction when necessary.

## New Automatic Control for Flowing by Air or Gas Lift



INGERSOLL - RAND COMPANY has announced the placing of the Maxiflo, an automatic control for flowing oil wells by air or gas lift, on the market.

The Maxiflo operates on the principle of fluid level control. It flows wells whenever and as often as the fluid level reaches a predetermined point. When the trap fills up to the desired pumping level, pressure conveyed to the surface through a small diameter pipe actuates valves which admit high-pressure air or gas to the well.

The flowing results from a combination of displacement and air or gas lift. When the trap is emptied of oil, the increased velocity of the air or gas actuates valves in the Maxiflo, cutting off the supply of air or gas to the well.

The Maxiflo has no timing devices and leaves nothing to human calculation. The only moving part in the well is a ball inlet valve in the trap. This opens and closes only once during each pumping cycle. Wear is thus reduced to a minimum and the expense of pulling rods is eliminated. The pumping process is practically continuous and is unaffected by sand that may enter the trap with the oil. No pressure is exerted on the producing formation at any time.

The Maxiflo represents a combination of Ingersoll-Rand developments and of the Smallamatic. License to use the patents of the latter device has been acquired from the Tidal Oil Company.

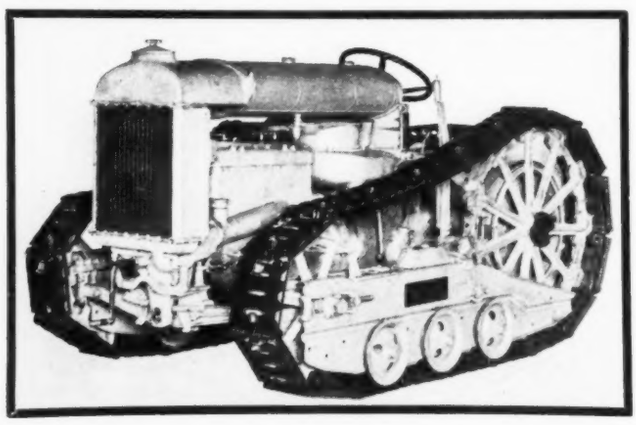
## New Model F Trackson Crawler

THE TRACKSON COMPANY, Milwaukee, Wis., has developed a new Model F Trackson Crawler for the new Fordson, which converts the latter into a more powerful, all-steel, two-ton crawler tractor.

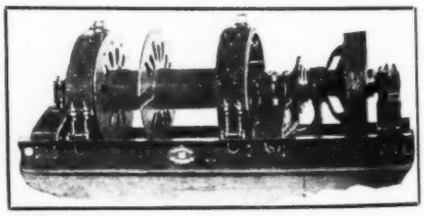
This unit offers sure footing and positive traction in all kinds of ground conditions, additional weight for bearing down on hard pulls, increased power, shorter turning radius, and great flexibility. Proper weight and balance and a track area of 1,100 square inches contact with the ground enables it to hug the ground and develop tremendous pulling power.

These Trackson Crawlers may be quickly and easily installed on the Fordson by any mechanic. It is merely a matter of removing the wheels and attaching the crawler with no special fitting, drilling or machine work required.

The Trackson Crawlers are built entirely of steel and have few working parts to wear out or break down. The tracks are made of heavy electric alloy steel castings, heat-treated and hardened to provide extra strength and resistance to wear. The sprockets are made of special alloy steel, light in weight but strong and durable.



## Parkersburg 7000-Foot Sand Reel



PARKERSBURG now offers a double-brake sand reel for 7000-foot operations, patterned after its Giant reel recently introduced for 10,000-foot operation. This new Type 70-A is similar in design to the big Type B, but built on a slightly smaller scale. A feature is the double oversize brakes which are adjacent and bolted directly to the 44-inch diameter spool flanges on either side, removing the shaft torsion.

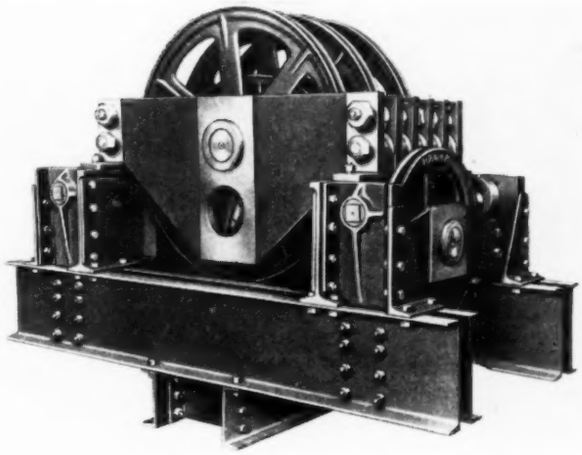
Features of construction are the heavy structural frame with diagonal bracing and an oversize drum with special heat-treated steel flanges of tapered design screwed to the drum center. For positive control it has linkage between the clutch and brake.

The spooling capacity of the live side is 7000 feet of 5/8-inch line and the reserve spool can handle 4,000 feet additional.

Complete data may be secured from the Parkersburg Rig & Reel Company at Parkersburg, W. Va., or from any of its representatives.

## Regan Introduces Nine-Sheave Crown Block

A COMPANION of the Regan extra heavy traveling block is announced by the introduction of a nine-sheave crown block, to be known as Regan Type C. It has a capacity of 650,000 pounds based on a factor 2 on the yield stress. While large in capacity it has a low center of gravity. The height of the block is decreased, which permits its installation with shorter gin poles. The block is likewise constructed with extreme compactness, embodying nine sheaves in the smallest space possible.



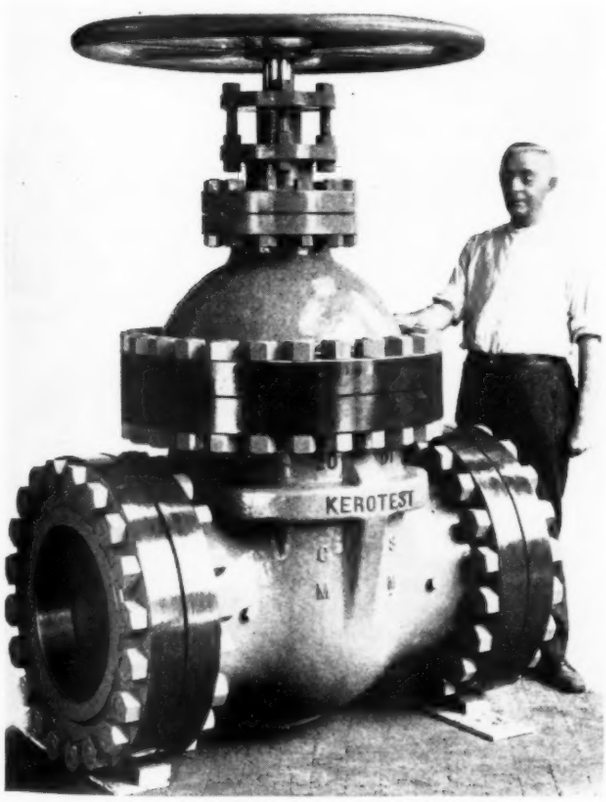
With the exception of sheave wheels the entire block is constructed from fabricated welded steel blades. The sand sheave can be positioned for use with the draw-works, sand reel or a special hoist, and will allow the line to be centered from the hole.

The cat-line sheave is adjustable and can be set in position above the driller's head, which is customary practice in the Mid-Continent fields, or it can be positioned at a medial point or at other locations as desired.

The block retains all of the features of the Regan Types A and B crown blocks. The bearing construction is the same, embodying dual bearings for each sheave and an individual rotating pin integral with its sheave. The bearing capacity has been increased in proportion to the capacity of the frame work of the block. The block is made by the Regan Forge & Engineering Co., San Pedro, Calif.

## 10,000 Pound 20-Inch Drilling Valve

KEROTEST MANUFACTURING COMPANY, Pittsburgh, Pa., recently constructed a 20-inch size, 3,000 pound tested, flanged end drilling valve, weighing approximately 10,000 pounds. According to the manufacturers this is the world's largest high pressure drilling valve and is a duplicate of valves used in the high pressure gas areas at Button Willow and Kettleman Hills, Calif., and in Trinidad and Venezuela. The valve has been subjected to a 24-hour test, using kerosene as the testing medium at a constant pressure of 3,000 pounds per square inch.




## New Type Register

A NEW register for use with gas or oil burners in refinery work has recently been designed by the Coen Company. This register provides full frontal insulation as well as great capacity, with little air pressure. It is designed to give a rotary motion to the air used for combustion without the use of air-directing vanes.

A new type outer torch door has been installed which permits observation of the flame without danger. It may be used with either a gas ring or with a straight oil fire. Full particulars may be had from the Coen Company, 428 Story Building, Los Angeles.

## Latest Dubbs Units to India

THE ASSAM OIL COMPANY will install in Digboi, India, two of the latest types of Dubbs cracking units. They will be equipped with two reaction chambers each so that one can be cleaned without shutting down the unit, and with radiant heat furnaces.

# RUNNING TOUR With Men In The Industry

Thomas R. Weymouth

Thomas R. Weymouth, chairman of the board of directors of the Oklahoma Natural Gas Corporation, Tulsa, has announced his resignation as an official of the company.

On November 1st Mr. Weymouth accepted a position as vice-president of the Columbia Engineering & Management Corp., with headquarters in New York City.

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W. B. Ewing, tool pusher for Humble Oil & Refining Company, at Jacksonville, Texas, is now residing at Hobbs, New Mexico.

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I. B. Chittenden has been employed by the Russian Government for the past two years as a consulting refining engineer. He makes his headquarters in Moscow. Mr. Chittenden has many friends in this country, having been employed as a designing and operating engineer by several companies in the Mid-Continent field. He was formerly employed by the Marland Oil Company, Texas Pacific Coal and Oil Company, the Burford Oil Company and the Blue Bonnet Oil Refining Company. Mr. Chittenden has had charge of the construction or reconstruction of refineries for these companies.

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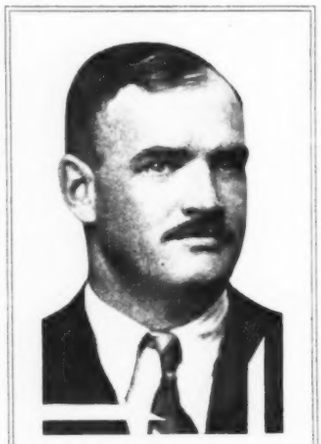

I. B. Chittenden

Martin Harris, formerly with the Lucey Products Corp., has joined the Elliott Manufacturing Company, of Los Angeles. He will cover the Mid-Continent field and at this time is at temporary headquarters in Oklahoma City. Offices will be opened in Tulsa about the first of the year.

Jack C. Ballagh

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Jack C. Ballagh, secretary of the Patterson-Ballagh Corporation, left for New York City shortly after the Oil Exposition in Tulsa. He will embark at New York for London. Mr. Ballagh will visit various oil fields in Germany and Roumania in the interest of Bettis Protectors and Bettis Drill Stabilizers. He was accompanied by Mrs. Ballagh.

James Prescott, of The Prescott Company, Menominee, Mich., will be sales representative for the company on the Pacific Coast.

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Theodore B. Wirth, formerly Mid-Continent district engineer for the Struthers Wells-Titusville Corp., has joined Petroleum Engineering, Inc., as sales engineer. He will continue to make his headquarters in Tulsa.

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Floyd Humphries, farm boss, Indian Territory Illuminating Oil Company, in Carson county, Texas, has been transferred to the O'Harrow well No. 1, in Schleicher County, Texas. M. E. Branton, farm boss, has been transferred from the company's Voshell lease, McPherson County, Kansas, to the Texas district, with headquarters on the Noel lease, Carson County, succeeding Mr. Humphries.

James Prescott

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C. C. Gilger, with Byers Drilling Company at Oklahoma City, underwent an operation for acute appendicitis last month, but is now able to be around again.

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J. E. Bish, tool pusher for Loffland Bros. Drilling Company, has moved from Lovell, Oklahoma, to Enid, Oklahoma.

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W. J. Nutto has been appointed manager of the Mid-Continent division of oil tool sales for the Chicago Pneumatic Tool Company. He will maintain headquarters at No. 1 West 16th St., Oklahoma City, Okla. Mr. Nutto has been associated with the company for a number of years.

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R. R. Dean, former chief engineer of the gasoline department of the Independent Oil & Gas Company, has left the company to become associated with John Haggart in a company organized to do general petroleum engineering and construction work. Mr. Dean entered the employ of the Independent company as chief engineer in April, 1927.

R. R. Dean

F. Hoving

F. Hoving has been appointed special oil-country representative by the Babcock & Wilcox Tube Company. Mr. Hoving was formerly with the Standard Seamless Tube Company (later Spang, Chalfant & Company, Inc.) as general superintendent and research engineer.

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Lee Croom, former storekeeper in the Seminole (Okla.) district for the Indian Territory Illuminating Oil Company, is acting storekeeper at Oklahoma City for the company, due to the resignation of W. B. Heywood. H. I. Sunderland, former assistant storekeeper at Bartlesville, is now acting storekeeper at Seminole.

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R. G. Allen, assistant general manager of Godfrey L. Cabot, Inc., formerly with headquarters in Pampa, Texas, has been transferred to Charleston, W. Va. His offices are in the Union Trust Building there.

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Al Hardy, mechanical engineer, Prairie Pipe Line Company, has returned to Tulsa from a two weeks' vacation in Chicago and Wisconsin.

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J. F. Hodge is now superintendent of the Tallant (Okla.) gasoline plant of the Empire Companies. He was formerly head of the Konawa (Okla.) plant. J. A. Dwyer, who was superintendent of the Sallyards (Kan.) plant, is now at Konawa, while A. E. Wakefield, tester at the Wichita (Kan.) plant, was promoted to superintendent of the Sallyards plant.

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Howard Slater, who has been head of the standardization department of the Gulf-Venezuelan Oil Company at Lake Maracaibo, has been transferred to New York City, where he takes up the duties of general purchasing agent.

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W. R. Luckfield of the engineering department of the Continental Oil Company at Ponca City, Okla., has been made division engineer of the Great Lakes Pipe Line Company, Ponca City.

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R. H. McPeake and B. W. Farnham, engineers, have joined the Carter Oil Company in the Seminole (Okla.) district. Mr. McPeake has been assigned to the gas-lift division, while Mr. Farnham will work in the gasoline department.

R. E. Martin

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R. E. Martin has been appointed Mid-Continent representative for Wm. Bros Boiler & Mfg. Co. Mr. Martin will maintain offices at 1425 Hunt Building, Tulsa.

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A. R. Smith, manager industrial division of the Continental Motors Corporation, Muskegon, Mich., has been visiting Tulsa and other oil centers in the Mid-Continent.

Dr. Eugene A. Stephenson, formerly of Pittsburgh, Pa., where he was associated with Ralph E. Davis as consulting geologist and engineer engaged in petroleum work, has accepted the position of professor of petroleum production in the Missouri School of Mines, Rolla, Mo., beginning this fall.

Dr. Eugene A. Stephenson

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J. B. Ray has been appointed Mid-Continent representative for the Tnemec Paint & Oil Company of Kansas City, Mo. Mr. Ray will make Fort Worth, Texas, his headquarters. He has had eight years' experience in studying field corrosion, particularly in West Texas.

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Buck Weaver, West Texas representative of Regan Forge & Engineering Company, with headquarters at Midland, Texas, was visiting old friends in the Oklahoma City field last month. He was formerly located in the latter field.

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Ray Sexton, Mid-Continent representative for W. C. Norris, manufacturer, is back in the home office at Tulsa, having spent the past month in the Hobbs (N. M.) and Texas Panhandle fields.

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R. A. Dunbar, vice-president of the Sargent Engineering Corporation, Huntington Park, Calif., visited the Mid-Continent last month.

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Warren Maxwell has been appointed superintendent of the Link-Belt Company, Dodge works, to replace F. J. Oakes, deceased. Mr. Maxwell has been assistant superintendent since January, 1929.

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Otto Praeger, engineer with the Shell Petroleum Corporation at Wood River, Ill., was married on October 18th to Miss Kittie Lucille Crowell of Tulsa.

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Edward Boaden, Phoenix Oil & Transport Company, Fenchurch Building, London, England, has been visiting many of the oil fields of the United States.

E. B. Wilber

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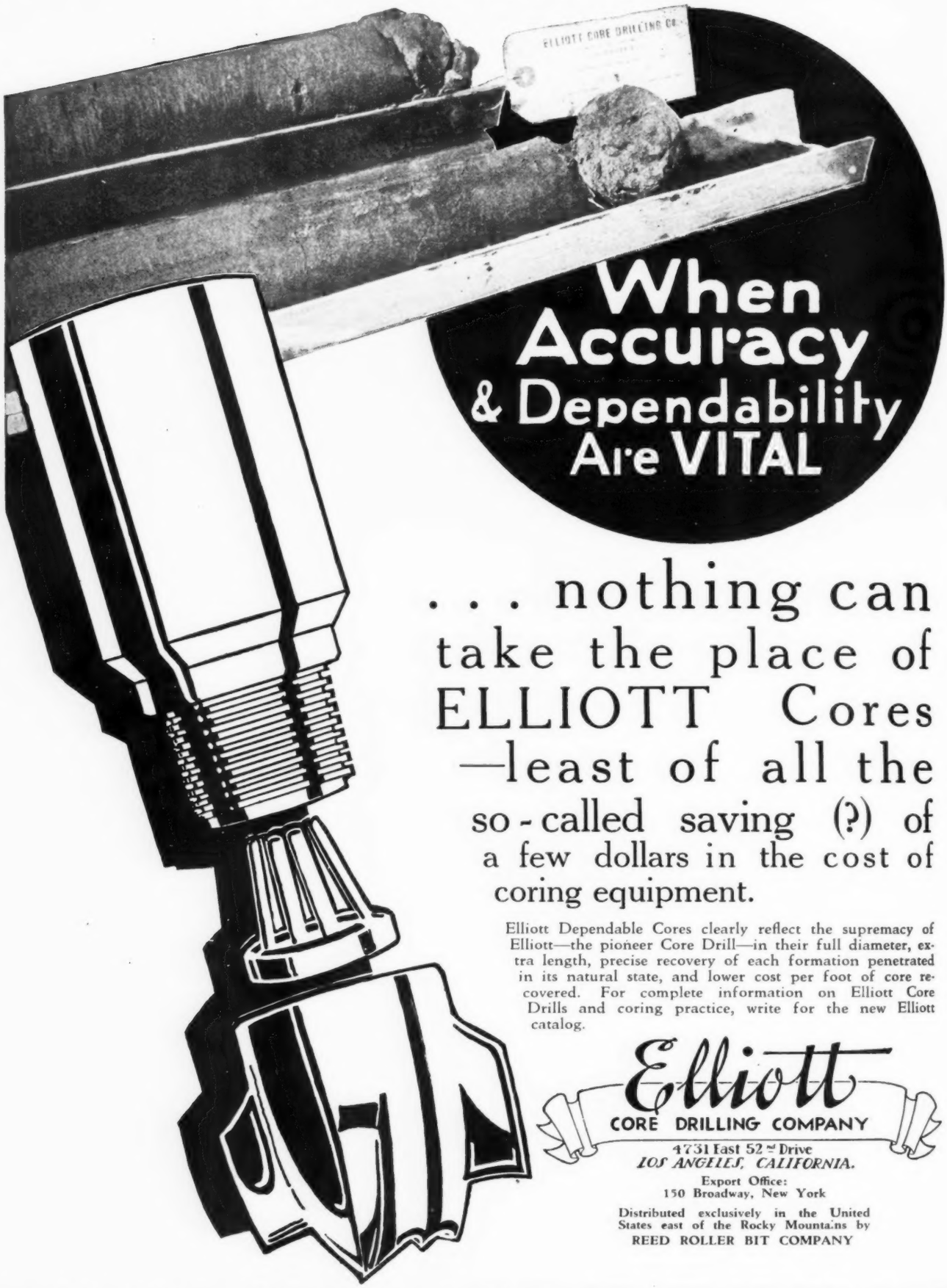
E. B. Wilber, district representative of the Aluminum Company of America, has opened offices in Dallas, Texas. He will divide his time between Dallas and Tulsa. The Aluminum Company of America has had offices for some time at 327 Exchange Bank Building, Tulsa, with Mr. Wilber in charge.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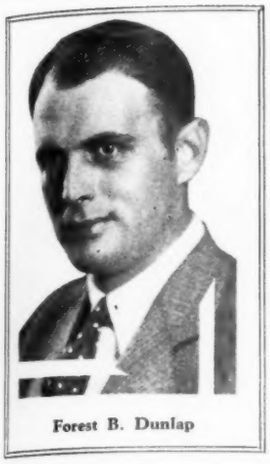

Forest B. Dunlap

Forest B. Dunlap has assumed the duties of district manager for the states of Oklahoma, Kansas, Arkansas and Colorado for the Climax Engineering Company. "Dunnie" will maintain headquarters in Tulsa, to which city he came in 1916 with the Bessemer Gas Engine Company. More recently he has been affiliated with Clark Bros. Co., of Olean, N. Y.

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E. L. Davenport, district superintendent for the Shell Petroleum Corporation at Wink, Texas, has been transferred to Hobbs, New Mexico. E. N. VanDuzee, field engineer for the same company at Wink, has also moved to Hobbs.

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E. J. ("Newt") Nordstrom, formerly purchasing agent for the Empire Gas & Fuel Company, Bartlesville, Okla., and for the past several years in the bond business at Dallas, Texas, has returned to Oklahoma as special representative of the Superior Tube Company, Inc.

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J. A. ("Jim") Morgan has returned to the Smith Separator Company organization. Jim was with the Smith company from 1923 until 1929. He is in charge of sales for the company.

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J. J. Rankin of Montreal, Canada, is the newly-elected president of Moose Oils, Limited. He was elected to this position recently at a meeting in Calgary.

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Harry L. Edwards, formerly an official of the producing department of the Humble Oil & Refining Company, has become associated with J. E. Mabee, prominent drilling contractor in the Mid-Continent. A separate company is being formed from the ones now belonging to the Mabee group. Mr. Edwards will be interested in this new company, which will operate in the Hobbs, New Mexico, district.

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B. W. Winters is the engineer in charge of construction work at the new Pure Oil Company refinery being built at Toledo, Ohio.

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J. B. ("Jimmy") Graham, with Ridge Tool Company, is now representing that company in Missouri, Kansas, Colorado, North and South Dakota, Montana, Nebraska and Iowa. He will maintain headquarters at Kansas City.

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C. C. Fuller was recently appointed manager of the Foxboro Company's New York office, succeeding the late W. W. Patrick.

J. B. Graham

Edward Blake is now affiliated with the Trimont Manufacturing Company in the capacity of general manager, according to an announcement of the board of directors.

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L. P. Maier has been made a vice-president of the Andian Pipe Line Company in Colombia. He was formerly chief engineer of the line and later an assistant to the president and a director of the company.

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O. L. Cordell, formerly in charge of sales and refining for the Independent Oil and Gas Company, is now in charge of refinery operations for the Phillips Petroleum Company. His headquarters will be in Tulsa.

Edward Blake

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Henry L. Phillips, former president of the Sinclair Crude Oil Purchasing Company, Tulsa, Okla., is now with the Sinclair Oil & Gas Co. at Tulsa.

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J. A. Morgan

H. D. Ruos has been made manager of the new sales, service and distribution office opened at 304 Capitol Street, Charleston, W. Va., by the Merco Nordstrom Valve Co.

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W. H. Larkin, vice-president of Larkin Packer Company, St. Louis, visited the Oklahoma oil fields last month. J. D. Talley, formerly with the Federal Supply Company at Oklahoma City, has been appointed field representative for the Larkin Packer Company at Hobbs, N. M.

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L. B. Mead of Indianapolis has been appointed assistant industrial manager of the northwest district of the Westinghouse Electric Company. He will now make Chicago his headquarters. With this promotion Wm. J. Morgan of Indianapolis succeeds Mr. Mead as Indianapolis manager for the firm.

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M. Halpern, assistant superintendent of the Port Arthur (Texas) works of The Texas Company, is at present on a trip to Europe for his company.

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C. C. McDermond was official representative of the Venezuelan government at the oil show last month. He flew all the way to Tulsa from Maracaibo, Venezuela, and is returning by the same method. More than 8000 miles of airways will have been covered by the time he reaches home. The trip was made to Tulsa in three and a half days flying time, whereas the trip by boat and train would have required sixteen days.

C. C. McDermond

*Edited by* **BARNEY HORRIGAN**

***An Open Letter to Bill Van Arsdale***

Tri-State Golfing Association.
Office of Secretary,
Mobile, Ala., 9-20-30.

Mr. W. G. Van Arsdale,
Jackson, Miss.,

Dear Sir:

By order of the Board of Directors of the above association, I have been assigned the unpleasant job of protesting your recent Burlesque on our dignified and scientific game of "Golf." This is all caused by several complaints to our association from different points covering our territory, but mainly from Jackson, Miss. These complaints will be listed below, but the most serious of all is your having photographs made and printed in "The Petroleum Engineer" of recent date, and an article by yourself, ridiculing this game of much dignity and character. Will Rogers wouldn't do such a thing as this, and we demand an apology from you, as this reflects our standing in this country of ours and our efforts to better this great game. Now listen, young man, we are not going to be kidded any more. We demand explanations from you on the following items, to wit:

First: While playing on the beautiful greens at Jackson, Miss., someone behind you gave the customary signal of "fore." You immediately yelled back "Five." This is a terrible breach of etiquette, and if you hadn't been a guest at that time, we would have had a near riot.

Second: Miss Bunker of Hattiesburg, while playing on the same course, and happened to be at the same "tee," where you were going to drive off, told you your stance was wrong. You told her your pants were all right and asked her how hers was. That's terrible, and you must apologize to her.

Third: In driving of the 5th tee at Mobile recently you drove the ball back of you instead of in front, thereby hitting Mr. Brown's cow amidships, causing said cow to strain her milk, and run through the barn sideways, meaning total loss to barn, garage, and feed bin. Instead of apologizing to Mr. Brown and offering to pay for cow and near cyclone, you laughed and said that cows were more considerate and polite in Oklahoma.

Fourth: Our professional at Vicksburg told you to use your "spoon" when you got in a trap. You told him your trap was closed like his ought to be, and that you stirred your coffee with your spoon; however, our Pro. states that your spoon was in your golf bag all the time. We class this as unnecessary.

Fifth: One of our members asked you one day if you were good on "Niblick" shots. You told him that you only used a Winchester pump gun for them in Oklahoma, but ducks were much better.

Sixth: At Mobile you were asked if you ever used your "mid-iron." You said that all your clubs had steel shafts and that iron was too heavy, especially in the middle.

Seventh: We supposed you remember talking to I. Slice in Mobile and his asking you if you had much luck in missing a Hazard, and your answer that in Oklahoma you had luck in missing a Hap Hazard in Tulsa several times, because you owed him some money. We believe this is a dirty crack of some kind.

Now for these pictures and article in "The Petroleum Engineer." For the above offenses we are going to send the two pictures to the Liberty Magazine, for the reason that Liberty offers prizes for drawings and pictures with the most mistakes in them. To date, the most mistakes in one picture has been ten. We believe these two pictures will take the grand prize as there is at least twenty mistakes to a picture, an unheard of and unbelievable event. For instance, viz.:

Picture No. One: Your eye or face is not on the ball, but on the flapper taking the picture, and the worst thing is, you are about to drive off the edge of the tee, and your "Driver" (golf club) is at least a foot from the ball, which will cause you to hit space and vacancy, and horrors! You are bareheaded, and the whole country full of woodpeckers. (That's bravery). Furthermore it looks like a power line pole sticking out of your shoulders, and why put a white flag on top of the ball. Another thing, you are wearing Dutch wooden shoes and not golf shoes. Well, let's forget this picture.

Picture No. Two: You are about to make a right-handed drive, but standing in a left-handed position, which makes you knock-kneed, stiff-jointed, instead of loose and knees clockwise. Your right hand should be where your left is. Your pants are coming down, so if you make this shot where you stand, you lose your pants, club, ball, and social standing. Your wrist watch is showing, and the left foot is half off the ground, just like you were about to "shake a leg." Do chiggers bother you much while playing "Golif" as you call it. Well! we can overlook some of these social errors, if you will employ our Professionals at our various courses, also a guide, ball chaser, and caddy, we will feel much safer, but this can't go on, as in the past. So, Mr. Van Arsdale, just choose your future course as outlined with apologies, or may we suggest, give up this game and start off again with mumblepeg, pinochle, marbles, and a little pipelining.

Yours in sorrow,
I. M. GREEN,
Social Secretary to Ass't Secretary.

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***It Makes a Difference***

The taxi driver put on his brakes suddenly, and came to a stop.

"What's the matter?" asked the man in the back seat.

"I heard the young lady say 'Stop!'"

"Never mind that. She wasn't talking to you."

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***Female Valet***

Ham: "What do you think of the chubby little bathing girl over there?"

Hearst: "She certainly packs her trunks."

From The Yellow Strand.

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The street car swayed from side to side. As it rounded a curve the drunk fumbled for his money.

"May I help you?" asked the conductor.

"If you will," said the drunk, "Just hold this darn strap while I get my money out."

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Lady Driver: "Tell me, George, quick!

Which is the right side of the road to keep on when you're running down a hill backward like this?"

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Her lips quivered as they approached mine. My whole frame trembled as I looked in her eyes. Her body shook with intensity as our lips met, and I could feel my chest heaving, my chin vibrating and my body shuddering as I held her to me.

The moral of all this is: Never kiss them in a flivver with the motor going.

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Sign in bathroom in the corner boarding house:

PLEASE CLEAN TUB
AFTER BATHING
LANDLADY.

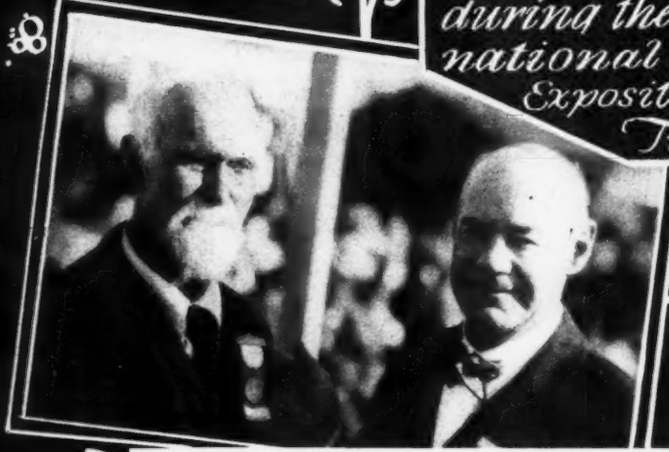
# Pictorial Petroleum

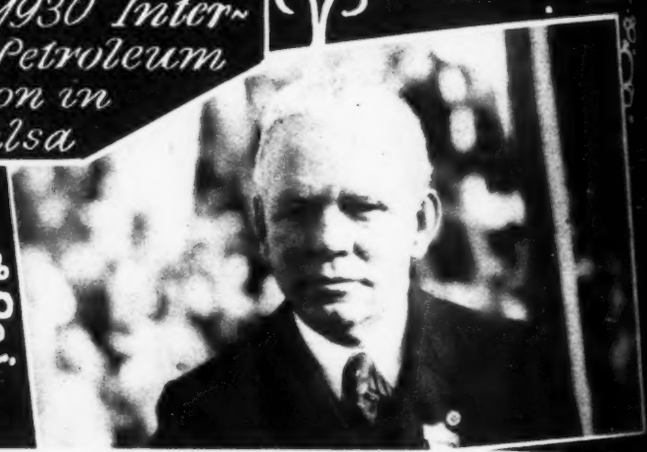
MONTHLY ROTOGRAVURE FEATURE
OF THE PETROLEUM ENGINEER
NOVEMBER 1930

Refinery of Imperial Oil, Ltd. at Ioco, British Columbia, said to be the largest refinery in Western Canada.

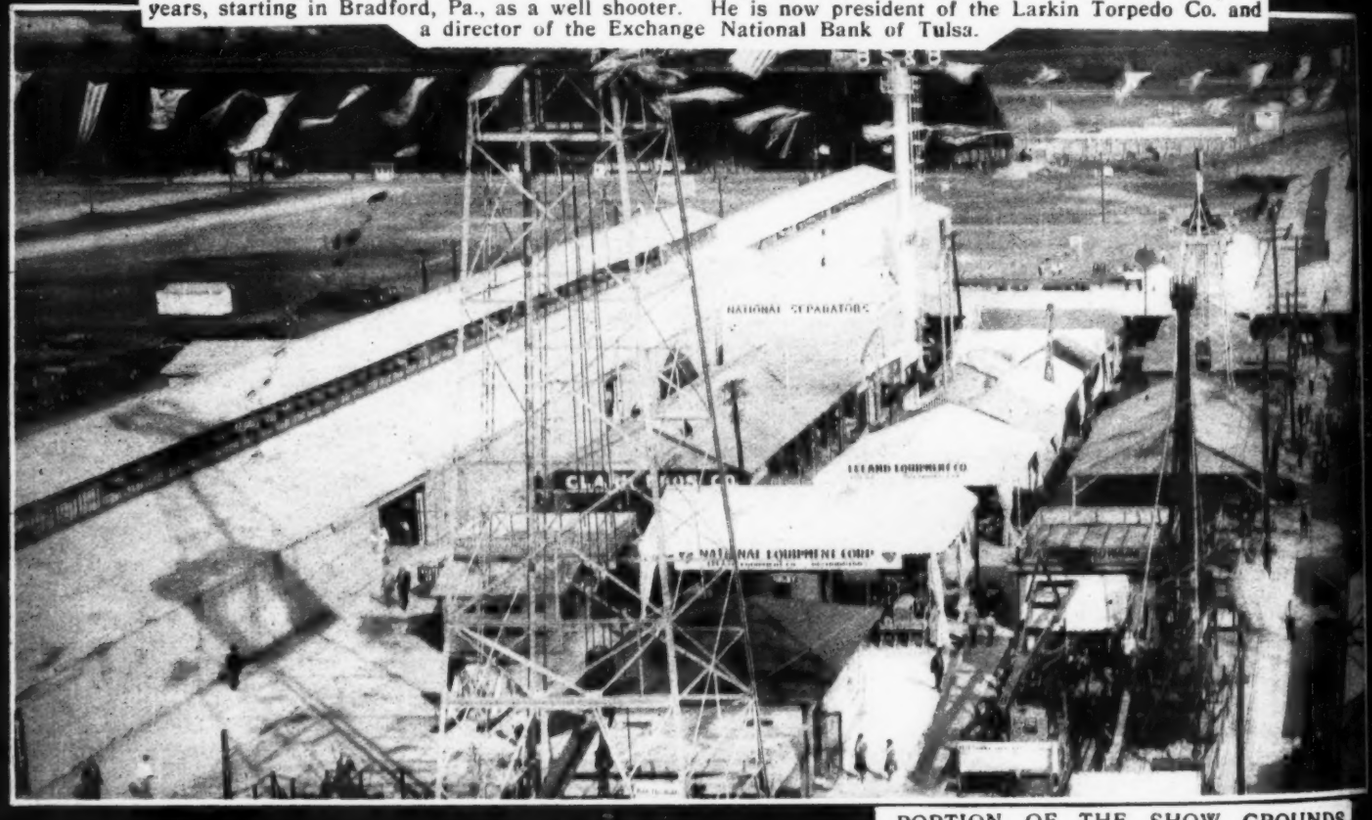
Views of two principal opening day speakers. Left—Patrick J. Hurley, secretary of war of the United States. Right—Henry L. Doherty, president of Henry L. Doherty & Co. and Cities Service Co.

*On this and the next three pages are scenes taken during the 1930 International Petroleum Exposition in Tulsa*

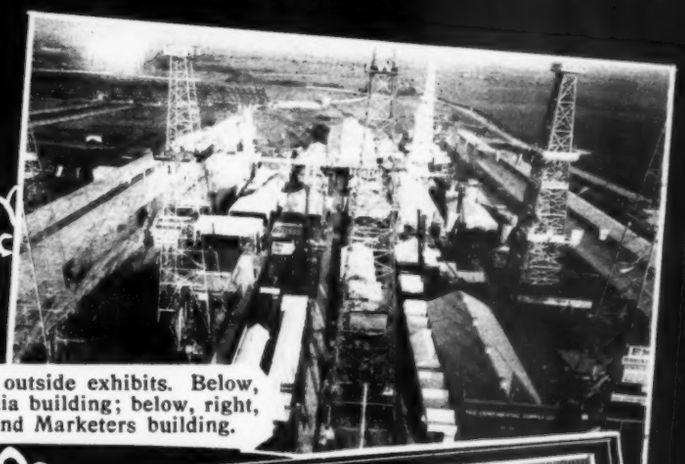




Left—Barney Horrigan, chairman of the "Old-Timers" committee has just pinned the ensignia of the "Grand Old Man" of the petroleum industry on E. H. Sloan, 85 years of age and now a resident of Pittsburgh, Pa., who for 45 years was a well shooter in Pennsylvania fields and was connected with the industry 67 years in all. Right—John J. Larkin, who was honored with the title of "Grand Old Man" of the industry in Tulsa. Mr. Larkin is 68 years old and has been identified with the oil industry 45 years, starting in Bradford, Pa., as a well shooter. He is now president of the Larkin Torpedo Co. and a director of the Exchange National Bank of Tulsa.

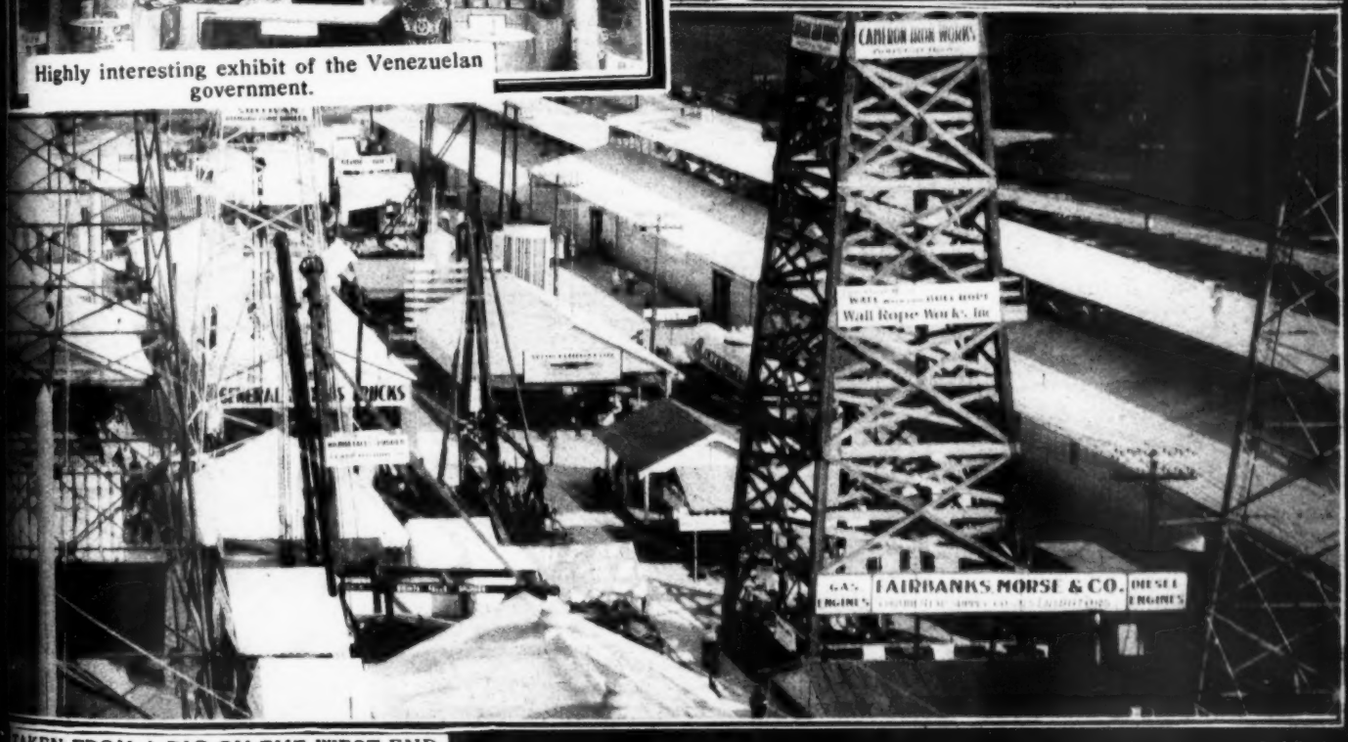



PORTION OF THE SHOW GROUNDS



Above—Two views showing outside exhibits. Below, left, entrance to the California building; below, right, entrance to the Refiners and Marketers building.

Highly interesting exhibit of the Venezuelan government.




TAKEN FROM A RIG ON THE WEST END.

# Views down the aisles of Four of the Main Buildings

Texas Building.

California Building.

Oklahoma Building.

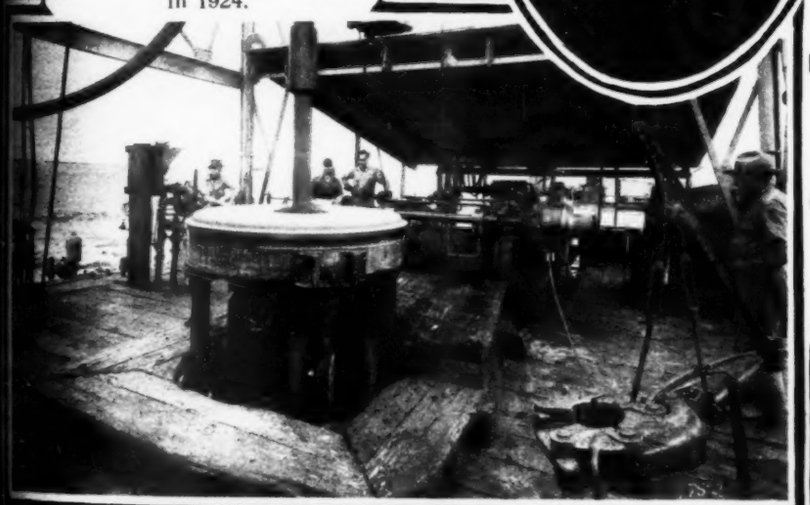
Scientific Building.

Texas Building.

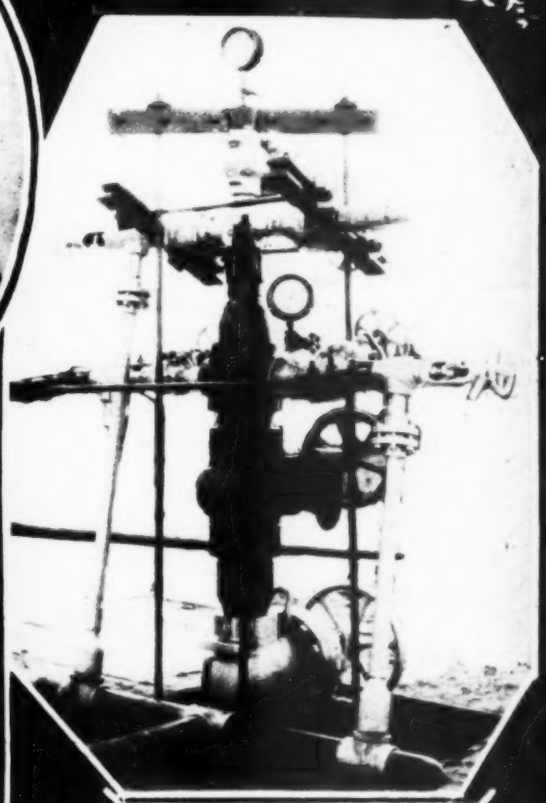
Scientific Building.

On the upper half of this page appear the photographs of some of the prominent men in the oil fraternity in Houston, Tex. Top row, left to right—W. J. Peddie of Maintenance Engineering Corp.; A. H. Arnim, purchasing agent Humble Pipe Line Co., Frank Carothers, Norvell-Wilder Supply Co.
At right, left to right — John A. Rowe, purchasing agent Humble Oil & Refining Co.; J. Z. Hill, purchasing agent Gulf Pipe Line Co.; L. H. Kennon, purchasing agent Rycade Oil Corp.

E. B. Maske, with Yount-Lee Oil Co., Spindletop, Tex. This picture was taken in Hull, Tex., in 1924.



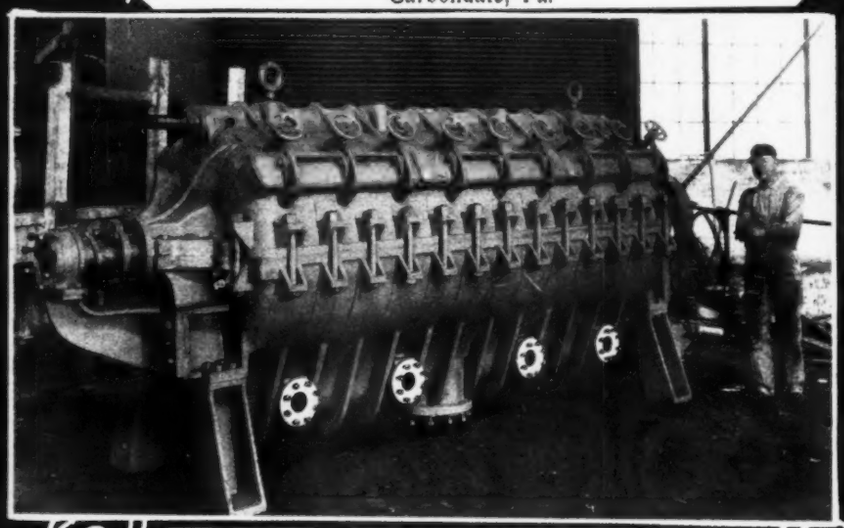
Hydril rotary equipment used by Hobson & King Drilling Co., Hobbs, New Mexico. Guy Powell is at the brake. Inset above —S. S. Parker, field superintendent, Doheny Stone Drill Co., Los Angeles, Calif., manufacturers of Hydril equipment.



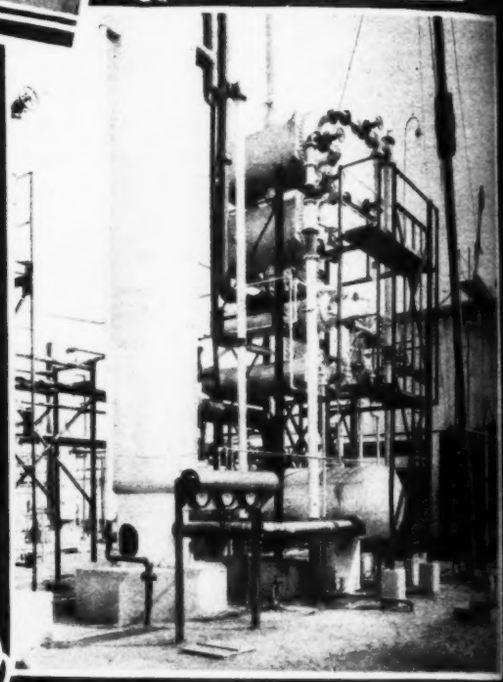
Universal tubing retractor on T. B. Slick lease at Pettus, Texas. This equipment is manufactured by J. H. McEvoy & Co.

W. L. Chapman (left) and L. P. White, with Goslin-Birmingham Mfg. Co., Harvey, Ill.

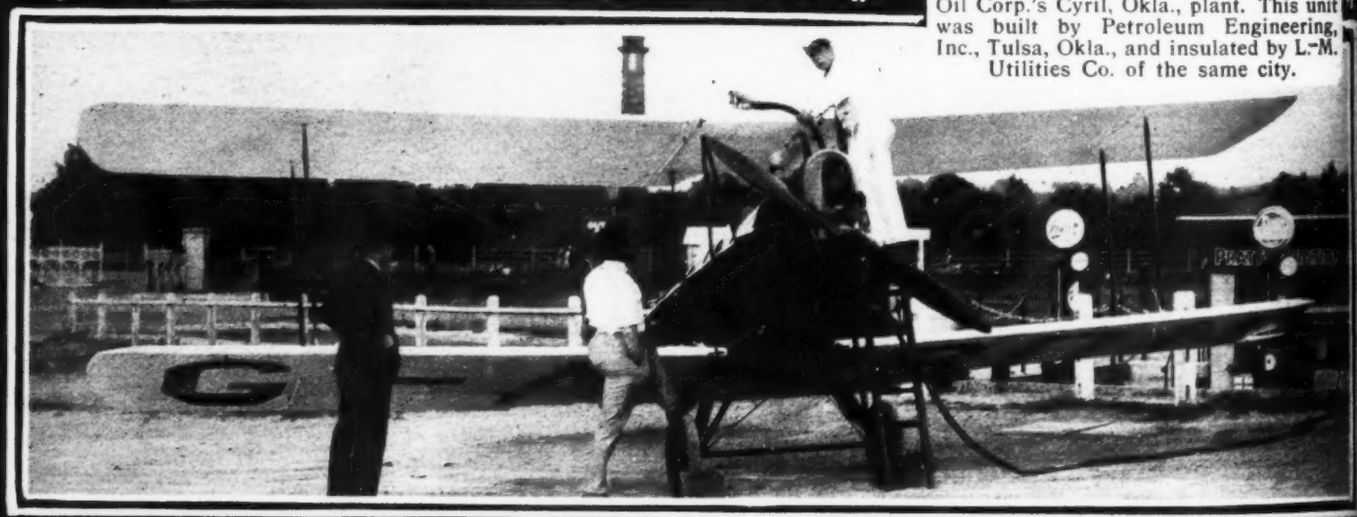
Left—Dr. George Fancher, professor of petroleum engineering, Colorado School of Mines. Center—A. G. Koenig (left) manager Dallas, Texas, district and R. M. Wilhelm, manager oil testing department, both with C. J. Tagliabue Mfg. Co. Right—Arden Ash, refrigeration engineer, Carbondale Machine Co., Carbondale, Pa.



Vallez filter press for contact filtration of petroleum products, manufactured by Goslin-Birmingham Mfg. Co., Harvey, Ill.



Fractionating unit at Anderson-Pritchard Oil Corp.'s Cyril, Okla., plant. This unit was built by Petroleum Engineering, Inc., Tulsa, Okla., and insulated by L.-M. Utilities Co. of the same city.



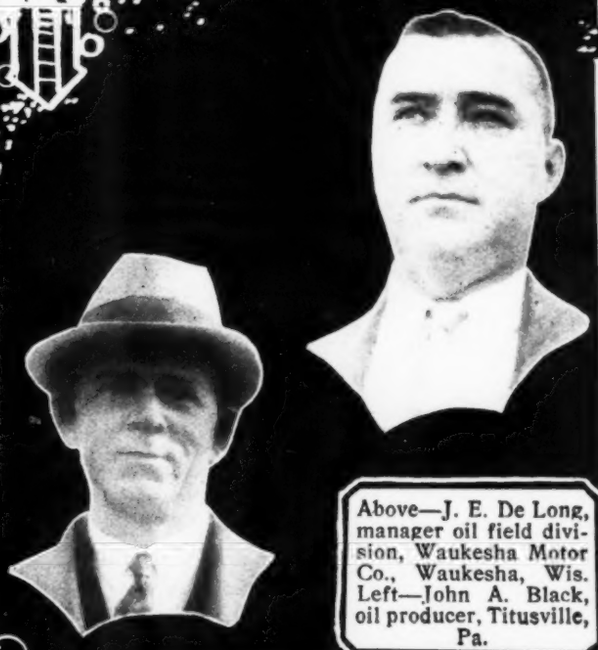
New Sports Avro Avian plane of Anglo-American Oil Co., Ltd., London, England. Besides serving as a means of rapid transportation, it is utilized as a test laboratory for fuels and engine oils.

George Noland, Jr., development engineer Barnsdall Oil Co., Tulsa, Okla.

Ferd J. Spang, vice president of Spang & Co., who with Mrs. Spang, recently drove from Butler, Pa., to Tulsa in his new Austin, is here being greeted upon his arrival by L. F. Porter, Spang & Co.'s Winfield, Kans., representative.

S. M. Squires, field superintendent, Turman Oil Co., Seminole, Okla.

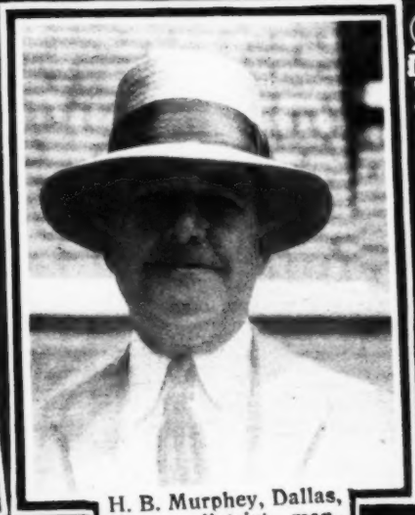
Joseph Waldeck, St. Louis district representative, The Lunkenheimer Co.



Above—J. E. De Long, manager oil field division, Waukesha Motor Co., Waukesha, Wis. Left—John A. Black, oil producer, Titusville, Pa.

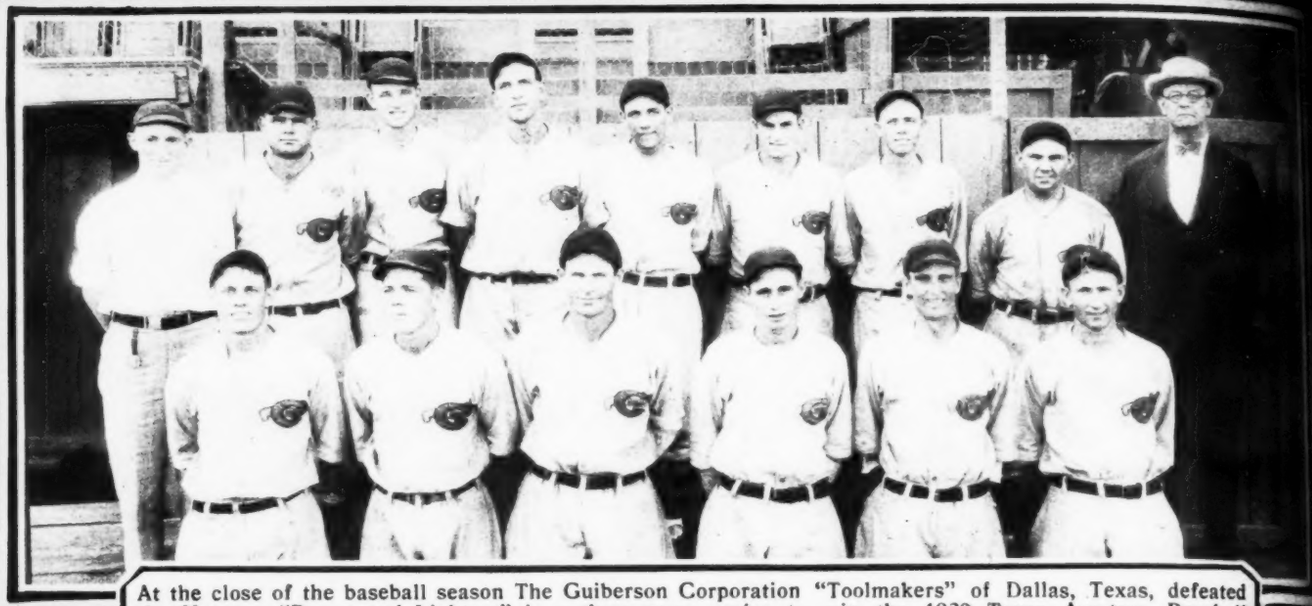
John J. Kovach, store manager for Continental Supply Co., Best, Texas.

Guy Triplett, superintendent Perry gasoline plant of Carter Oil Co., Seminole field.

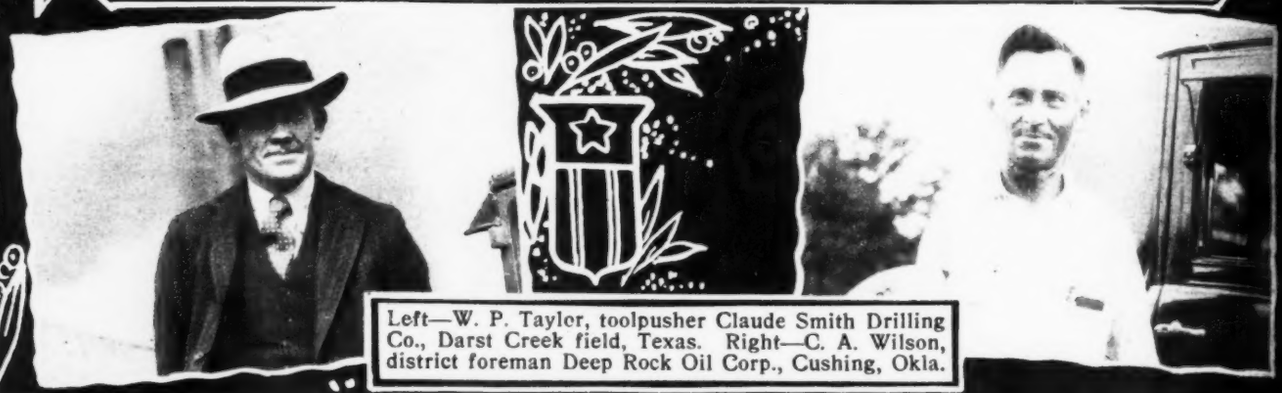


H. B. Murphey, Dallas, Texas, district manager, Chicago Bridge & Iron Works.

M. C. Hutchinson, sales engineer Victaulic Co. of America, New York City.



At the close of the baseball season The Guiberson Corporation "Toolmakers" of Dallas, Texas, defeated the Houston "Power and Lighters" in a three-game series to win the 1930 Texas Amateur Baseball Championship. Personnel of the Guiberson team follows: Front row, left to right—Babe Mims, right field; Ray Titsworth, utility; Horace Caldwell, pitcher; Noel Toney, utility outfielder; Dutch Boyd, shortstop and co-manager; Paul Williams, center field. Back row, left to right—Co-manager Smith; Dave Cheeves, pitcher; Percy Andrews, second base; George Eugene Johns, first base; Charley Chenshaw; third base; Sonny Hickcox, left field; Herman Ferguson, pitcher; Nolin Greenwood, catcher; Nat Guiberson, backer of the team.



Left—W. P. Taylor, toolpusher Claude Smith Drilling Co., Darst Creek field, Texas. Right—C. A. Wilson, district foreman Deep Rock Oil Corp., Cushing, Okla.

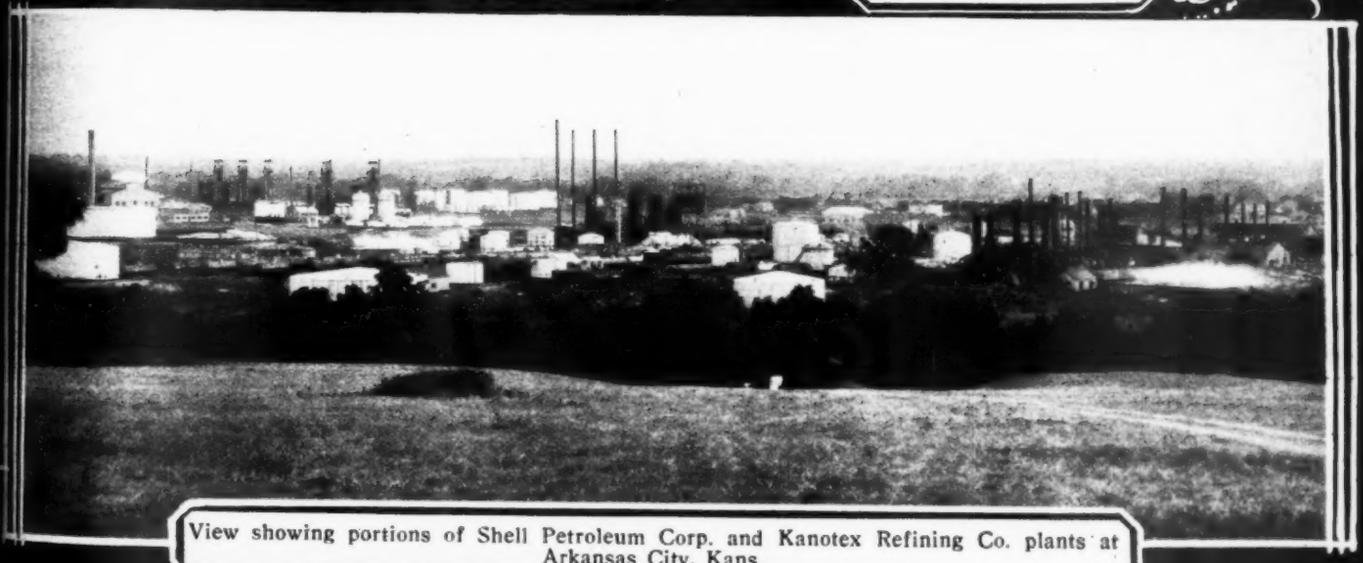
Representatives of companies winning awards in the 1930 Petroleum Section Safety Contest held recently in connection with the Annual Safety Congress in Pittsburgh. Front row, left to right—L. A. Brower, Gulf Pipe Line Co., Lufkin, Texas; O. O. Perry, Hope Construction & Refining Co., Clarksburg, W. Va.; T. N. Shaw, Midwest Refining Co., Midwest, Wyo.; B. V. Osborn, Standard Oil Co. (Ind.), Casper, Wyo.; J. S. Hunter, Atlantic Refining Co., Philadelphia, Pa.; G. L. Farned, Humble Oil & Refining Co., Ingleside, Texas; W. C. Lynch, General Petroleum Corp. of California, Los Angeles, Calif.; J. P. Sutton, The Ohio Oil Co., Findley, Ohio. Back row, left to right—G. W. Bell, The Ohio Oil Co., Casey, Ill.; R. B. Roaper, Humble Oil & Refining Co., Houston, Texas; H. D. Kettell, Standard Oil Co. of N. J., Baltimore, Md.; R. W. Black, Standard Oil Co. of N. J., Elizabeth, N. J.; E. R. Alden, Vacuum Oil Co., New York City; I. W. Lobb, Vacuum Oil Co., Bayonne, N. J.; R. C. Byars, Shell Petroleum Corp., St. Louis, Mo.; J. L. Matteson, The Texas Company, Port Arthur, Texas; Chas. H. Linberg, Connewango Refining Co., Warren, Pa.; L. W. Dawson, Shell Petroleum Corp., Sellers, La., R. E. Donovan, Standard Oil Co. of Calif., San Francisco.

A. H. Rinev, chief engineer Phillips Petroleum Co., Bartlesville, Okla.

A group of men well known in the petroleum industry on a fishing trip in Mexico in 1924. Left to right—F. R. "Doc" Oldham, purchasing agent, Gulf Production Co., Houston, Tex.; Dick Corneilson, New England Fuel Oil Co., Tampico, Mex.; P. J. Oliver, purchasing agent, Mexican Gulf Oil Co., Tampico; W. M. Mitchell, Magnolia Petroleum Co., Dallas, Tex.; Harry C. Potts, representative at large, Kerotest Mfg. Co.; Ted Swenson, purchasing agent New England Fuel Oil Co., Tampico.

W. E. Leckie of Agwi Co., Tampico., Mex., fishing on a Mexican stream.

Allmand M. Blow, vice president and general manager Amerada Petroleum Corp., Tulsa, Okla.



View showing portions of Shell Petroleum Corp. and Kanotex Refining Co. plants at Arkansas City, Kans.

Oil Well Supply Co.'s store at Tonkawa, Okla., during the boom days of 1923. M. C. Yeaman, now with L. W. Prunty Drilling Co., Ponca City, Okla., was manager of the store when the picture was taken and it is through his courtesy that we reproduce it. Men still connected with the petroleum industry as identified by Mr. Yeaman are, front row, left to right—Charlie Markey, Link-Belt Co.; Harry Byers, American Iron & Machine Works: Arch Clevenger of Allison & Clevenger, drilling contractors; fourth man unknown; W. H. "Kid" Hill, formerly of Hill, Jones & Bell, drilling contractors; C. M. "Blondy" McCool, now with Independent Oil & Gas Co., Tulsa, Okla.

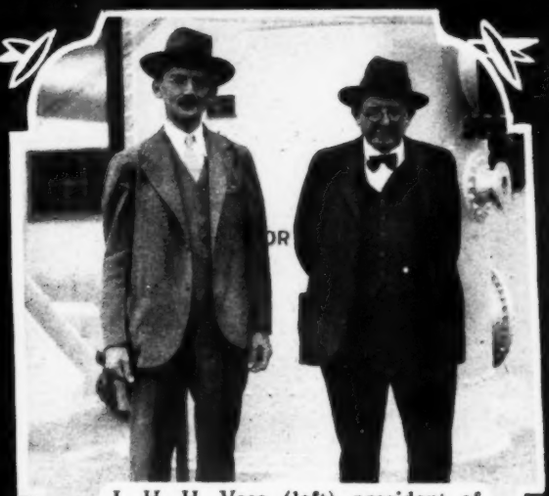
Left oval—H. M. Myracle, secretary - treasurer American Iron & Machine Works Co., Oklahoma City. Right oval—J. B. O'Connor, recently made general sales manager of Clark Bros. Co., Olean, N. Y.

H. N. Macomber, vice president and general manager, George F. Getty Petroleum Co. (left) and L. R. Manning, field superintendent, of the same company. Both men are now located at Hobbs, New Mexico.

The Texas Company's Lake Barre wells No. 2 and No. 3 in South Louisiana field.

L. C. Hawkins, division superintendent for Oklahoma, Magnolia Petroleum Co.

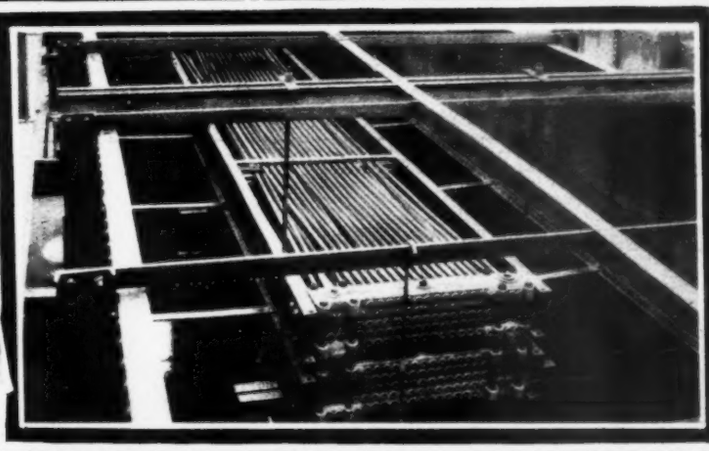
R. P. Abele, vice president in charge of production for Sunray Oil Co., Tulsa, Okla.



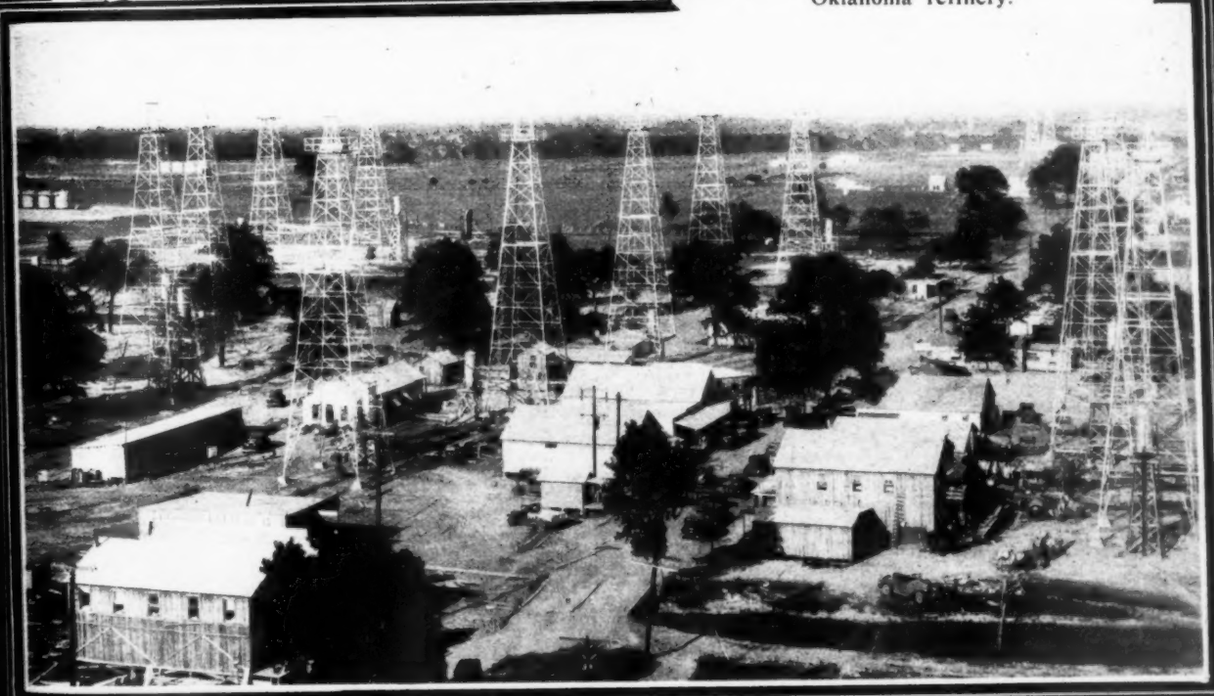
J. H. H. Voss (left) president of J. H. H. Voss, Inc., valve manufacturers, New York City, and A. W. France, president France Packing Co., Philadelphia, Pa.

Virgil Burton, still foreman Cosden Oil Co., Big Spring, Texas.

Murray Tool & Supply Co.'s store and warehouse at Hobbs, New Mexico.

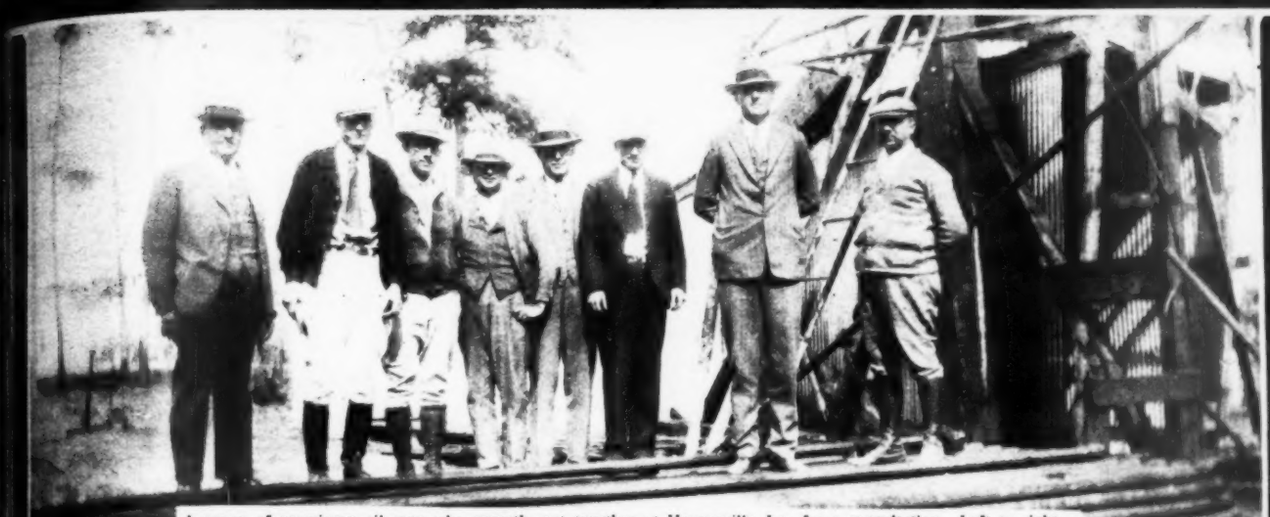


Griscom-Russell single pass bentube sections serving as condensers on a batch still in an Oklahoma refinery.



International Derrick & Equipment Co., derricks in the Van, Texas, field.

More than 400 members of the Oklahoma-Kansas division of the Mid-Continent Oil and Gas Association, together with a number of foreign visitors, attended this banquet on the closing day of the annual meeting of the division held in Tulsa, Okla., recently. C. C. Herndon, vice president of Skelly Oil Co. and retiring president of the division acted as toastmaster. Alvin Richards of Pure Oil Co., the newly elected president, was introduced at the dinner.

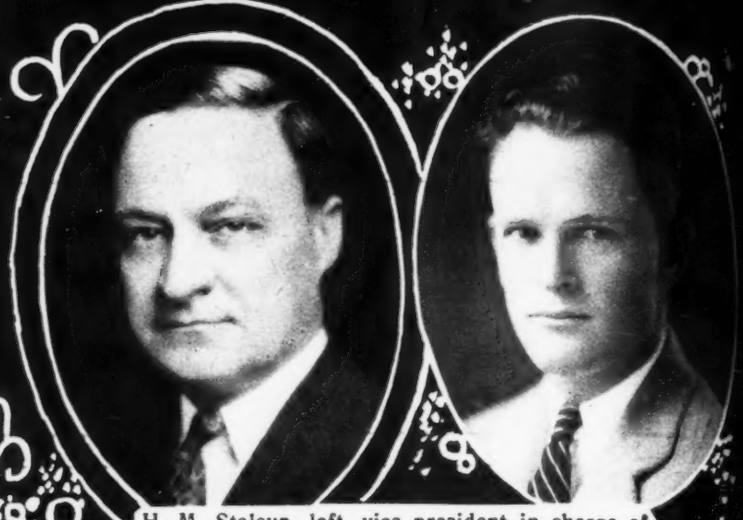


A group of prominent oil men who recently got together at Haynesville, La., for a consultation. Left to right—J. S. Hasson, Shreveport, La., Gen'l. Supt. Louisiana-Arkansas division of The Ohio Oil Co.; Millard H. Flood, petroleum engineer, Haynesville, La.; E. B. Charlton, in charge production and pipe lines in Haynesville district for The Ohio Oil Co.; Earl Clover, in charge gasoline manufacture for Reserve Petroleum Co. in Haynesville and Homer, La., areas; J. K. Kerr, v. p. The Ohio Oil Co., Marshall, Ill.; W. H. Vaughn, dist. supt. in charge gasoline manufacture for Gulf Refining Co. at Shreveport; M. E. Waldron, dist. supt. of production, Louisiana Oil & Refining Corp., Shreveport; C. W. Warwick, Camden, Ark., genl. supt. gasoline manufacture in Louisiana and Arkansas.

Recent group photograph of a part of the personnel of The S. M. Jones Co., manufacturers of Jones sucker rods. Left to right—D. R. Dale, engineer, Toledo, O.; H. S. Downing of Walker & Downing, Pittsburgh, Pa., who handle the Jones sucker rod advertising; W. C. Meeks, representative at Wichita, Kans.; W. E. Harvey, Oklahoma representative; M. P. Reynolds, representative at Amarillo, Tex.; S. L. Carter, Fort Worth, Tex.; J. G. Litherland, Shreveport, La.; C. A. McClure, Oklahoma representative; P. C. Jones, president of the company, Toledo, O.; L. J. Pundt, Houston, Tex.; A. L. Meeks, Western Manager, Tulsa, Okla.

This group of Texas Company officials was photographed during a recent inspection tour of Mid-Continent properties: Left to right—R. Ogarrio, v. p. in charge of production; V. L. Porter to Mr. Ogarrio; E. D. Hopkins, secretary to Mr. Ogarrio; J. L. McMahon, div. mgr., Wichita Falls, Tex.; R. C. Stewart, div. mgr., Shreveport, La.; E. R. Filley, div. mgr., Tulsa, Okla.; H. N. Pardee, asst. div. mgr., Tulsa, Okla.; R. F. Baker, chief geologist, New York City; J. A. Bermingham, v. p., Los Angeles, Calif.; W. V. Bowles, div. mgr. Houston, Tex.

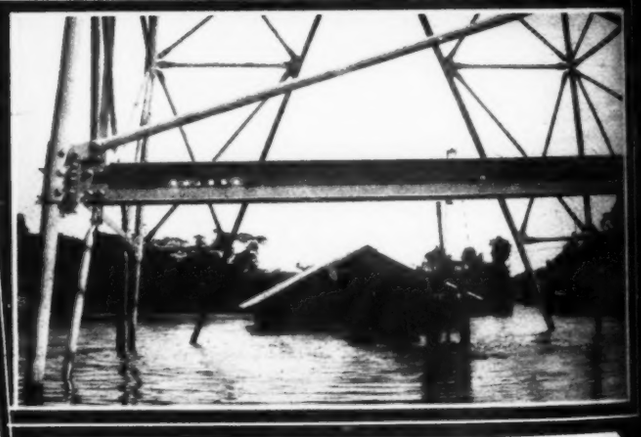
Freeman W. Burford, president Burford Oil Co., Tulsa, Okla.



H. M. Stalcup, left, vice president in charge of production, Skelly Oil Co., Tulsa, Okla., and right, his assistant, J. S. Freeman.

A. W. France, president France Packing Co., Philadelphia, Pa.

New home of Wheatley Bros., Sand Springs road, Tulsa, Okla.



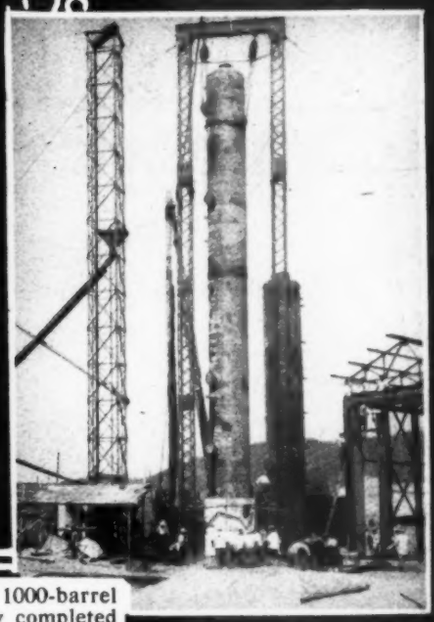
Left—Men in charge of Filisola lease of Mexicana De Petroleo Le Aquita, Mexico. Left to right—H. H. Sundquist, assistant superintendent; J. C. Lewis, production foreman; E. H. Hapgood, district superintendent, and, G. P. Brown, master mechanic. Above—Flood picture taken at Francita, Mexico. Water conditions such as shown are to be contended with in the district six weeks each year. Pumping jacks are bobtailed to meet the emergency. Photographs by courtesy Jensen Bros. Mfg. Co., Coffeyville, Kans., whose jacks are shown in use.

J. W. Glass, superintendent, White Eagle Oil & Refining Co., Casper, Wyo.

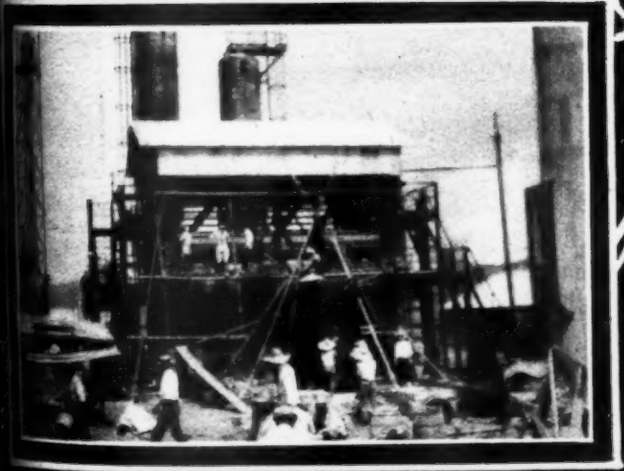
W. R. Borough (left) superintendent and T. J. Landry, his assistant, with International Refining Co., Sunburst, Mont.

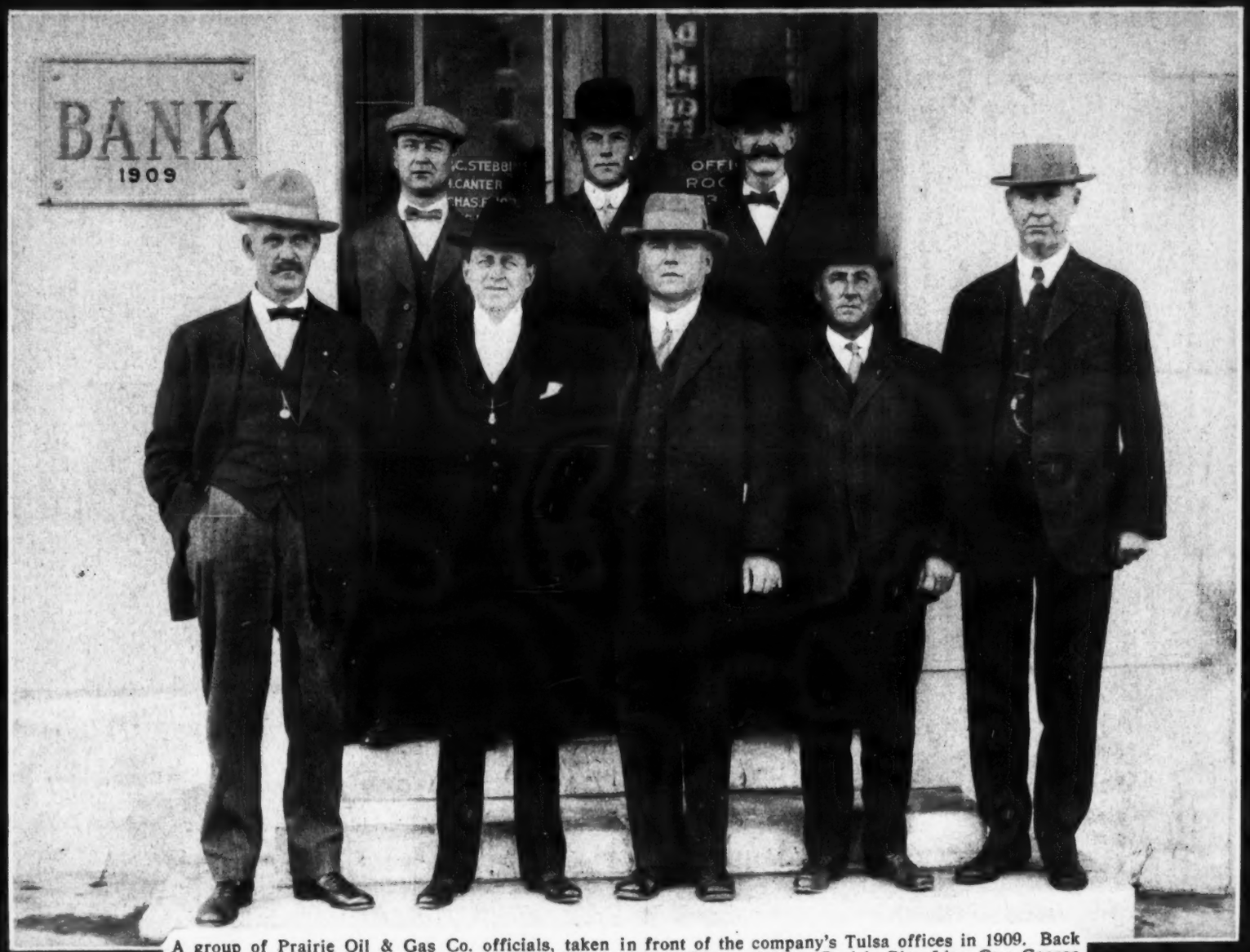
J. C. Davis, purchasing agent, Texas Pacific Coal & Oil Co., Thurber, Texas.

E. R. Wiles, Barnsdall, Okla., chief chemist, Barnsdall Refining Co.



These four photographs were taken during construction of a 1000-barrel Cross cracking unit which The M. W. Kellogg Co. recently completed for the Nippon Oil Co. at Kudamatsu, Japan. In the picture on the left the bubble tower is being raised; on the right the bubble tower is shown on its foundation; below left is shown stack end of furnace and preheater; below right, the unit almost completed.






A group of Prairie Oil & Gas Co. officials, taken in front of the company's Tulsa offices in 1909. Back row, left to right—T. R. Lott, now general superintendent Texas division Prairie Pipe Line Co.; George E. Casey, then assistant general superintendent pipe line department; John C. Bennett, general superintendent production department. Front row—W. R. Luckfield, telegraph operator; Harry Gibney (deceased) who was clerical assistant to Mr. Bennett; George Coyle (deceased) who was general superintendent pipe line department; Ed Latimer (deceased) assistant superintendent pipe line department; R. S (Uncle Dick) Gray at that time superintendent land and lease department.

*"See American First"*

*Illustration does not show connections or exact location of float.*

**The Improved AMERICAN Oil and Gas Separator has made the outside float obsolete! Why employ a boy to do a man's work?**

**To properly function and to allow for great capacity a larger float was designed by the engineers who built the Improved AMERICAN Oil and Gas Separator.**

**This oversize float does as much as ten of the ordinary outside controls. It operates on ball bearings; it works automatically; it is foolproof; it is protected from sediment.**

# The Improved *American Oil & Gas Separator*

**Equipped With B. S. & B. Spray Condenser**

**This new Separator—the Improved AMERICAN with its many different and distinctive features—is revolutionizing oil and gas separation. It's not only in the construction, but in the results.**

**This model was built by engineers, proved by engineers' tests and actual operations in the field.**

**Here's a Separator that can handle an enormous production, being adjustable to various volumes, pressures and conditions, and in every case *insures 100% dry gas.* Each minute particle of oil is stripped from the gas. Gas is delivered to gas lines as they want to buy it—DRY!**

**This Separator is equipped with the B. S. & B. Spray Condenser, which strips every trace of oil from the gas. The Inlet itself is on the inside, the flow coming in *at a tangent,* saving wear and tear and producing a greater centrifugal effect. This Separator takes full advantage of centrifugal force, velocity and gravity!**

**Because of the design and construction, the Improved AMERICAN may be rolled like a barrel, which makes it easier to transport and handle. Each is equipped with steam coil connections, and steam coils may be furnished. Our easy-to-clean-out sand hopper for fields where sand conditions are unfavorable is another special feature—furnished when needed.**

***There is no Separator made today like the Improved AMERICAN. Let us prove its many advantages. Please address inquiries to Dept. CA-7.***

**American Tank & Equipment Corp.**

A SUBSIDIARY OF
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OKLAHOMA CITY — OKLAHOMA

(*Formerly* AMERICAN TANK COMPANY)

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## *Problems Attending* » » »

# Winter Treatment *of* Emulsified Oil

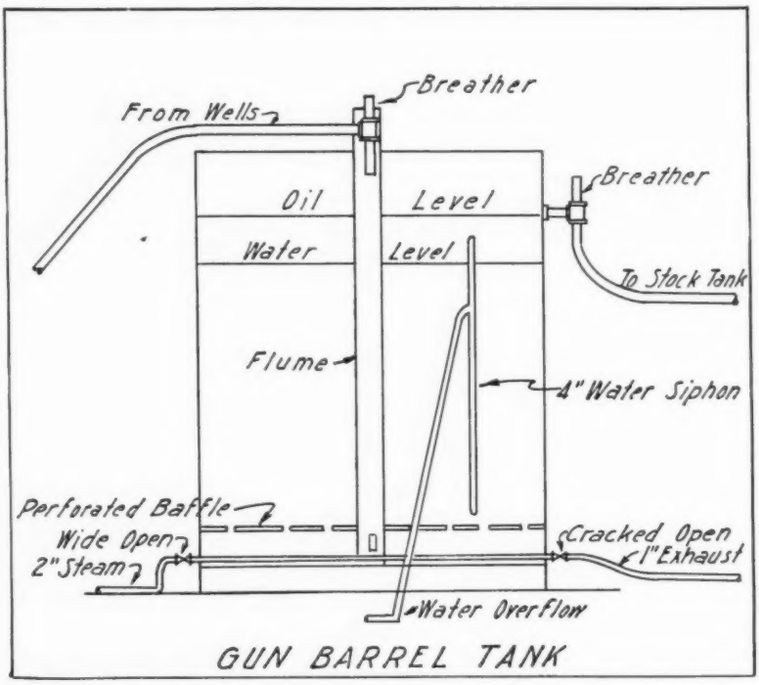
*By* W. ANGUS ROSS, *Mechanical Engineer, Great Lakes Pipe Line Co.*

"WHEN WINTER COMES" was the title of a famous novel; it might well serve as the preface to the query as to what is going to be done this winter with that Hardy Annual—"cut oil". It is a sad fact that the moment senility occurs in the life of most wells, the old enemy, emulsion, makes its appearance.

It is as unwanted and unwelcome as it is without use or merit, which being so, there is no use delaying treatment of it. All cut oil is amenable to treatment so that the emulsion may be broken down to its two component parts of water and oil. Once separated, it is no trick to take off the oil and bleed off the uneconomic portion, the water.

It is generally recognized nowadays that there is money in B. S. provided its structure is broken up. But it is a moot point whether the most is being taken out of the emulsion in the average case and at the least expense.

There are several simple principles of first-hand importance relating to treatment of cut-oil that are intimately associated with economy of oil, gravity A. P. I. of the petroleum evaporation losses, thermal applications through the treating plant, chemical costs, and the overall cost of conversion of the emulsion.




### *Heat Prime Treater*

The general modus of attack on the subject is through heat. This physical factor is of intrinsic value in breaking up emulsion, but it is not generally recognized that there is a decided elastic limit to the temperatures that can be economically applied to the fluid. This limit is dependent first on the original gravity of the oil, so that the higher the gravity is, the lower must be the temperature carried. Any transgression in this respect will cause evaporation losses in the more volatile hydrocarbon fractions, with its consequential lowering of the gravity and of the price obtained for the treated oil.

Secondly, unless the treating system is more or less a closed one with a heat application part of the treatment, losses will again occur due to evaporation.

The moral of the story then is to maintain low temperatures, and to run a closed rather than an open treating plant.

Since the day when producers ceased to dump B. S. down the creek to the tune of sulphurous language, and instead, bent studied efforts to extract the profitable element out of the emulsion, cut-oil treatment has developed from a cursory task to one of skilled chemical and engineering practice.

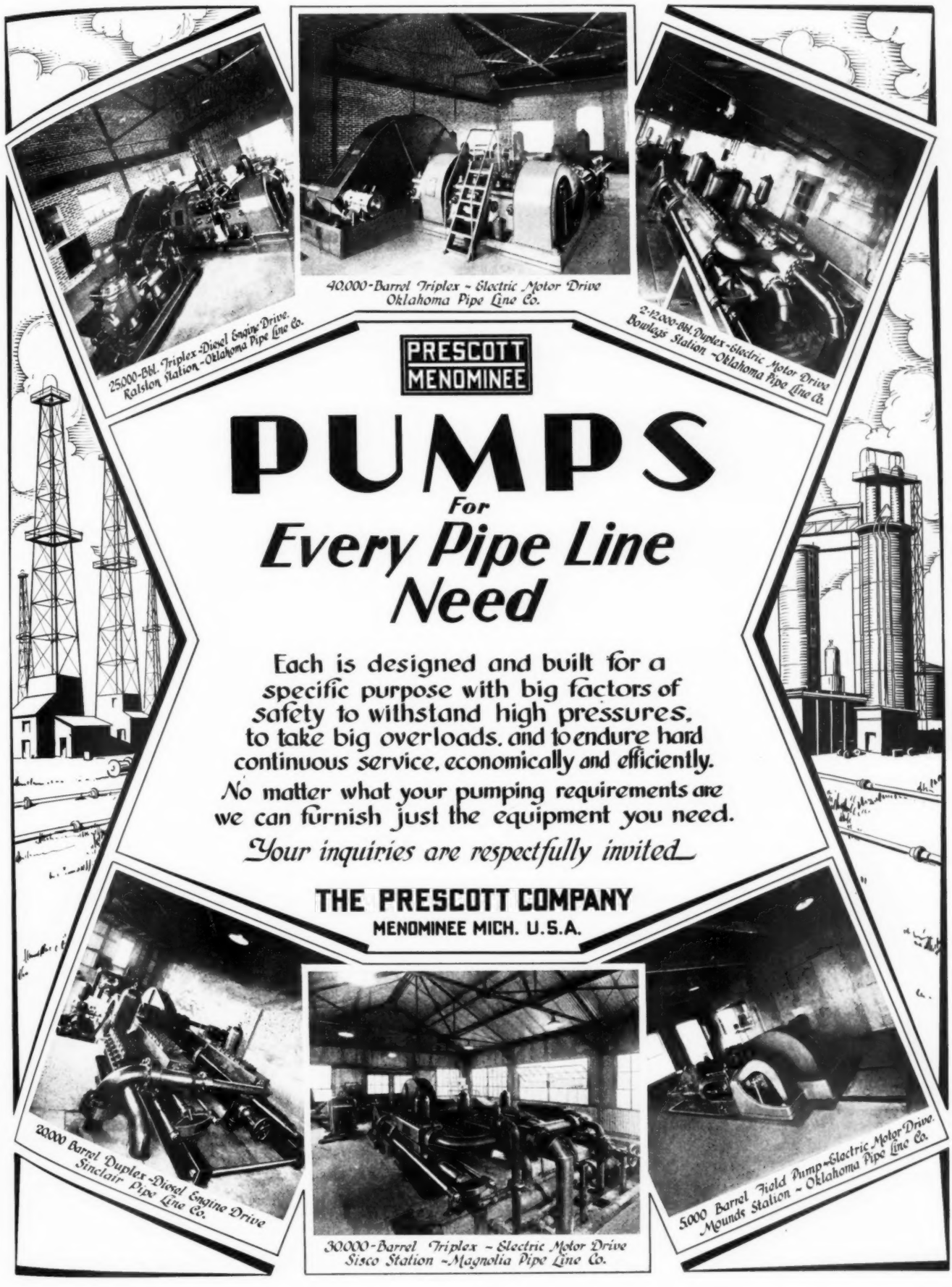
Many companies, and wisely so, maintain their own treating engineers and what those men save in the year in oil gained, heat saved, evaporation losses reduced, gravity maintained to result in a better market price, better and bigger application of chemical treatment compounds resulting in lower demulsification practices may, in some cases, not be computed to dollars and cents, but is certainly a very large multiple of the expenses incurred in using the service of such a skilled operator.

### *Chemicals Cut Gravity Losses*

If any particular emulsion proves reluctant to treatment by heat alone, the general practice is to supplement the thermal application with a well-gauged chemical treatment. In the past several years, the chemical compounds used on emulsions have greatly improved in character and efficiencies. There are several brands well known and well adapted for the work in hand with the decided additional merit of having, when necessary, another compound manufactured when some new emulsion makes its debut in some new field.

Producers should recognize one point in this matter, and that is, that they can get plenty of skilled service from the chemical manufacturers any time they encounter difficulties. Not only will those service men gratuitously donate their skill and knowledge on the chemical side of the equation, but will also advise on the best type of treating plant to use on the recalcitrant fluid.

Use their offerings. They have no axe to grind in any equipment they might recommend, while the results obtained on any chemical test by the compound of one maker can readily be matched with those resulting from the tests


25000-Bbl. Triplex-Diesel Engine Drive.
Ralston Station-Oklahoma Pipe Line Co.
40000-Barrel Triplex - Electric Motor Drive
Oklahoma Pipe Line Co.
2-12000-Bbl. Duplex-Electric Motor Drive
Bowlegs Station -Oklahoma Pipe Line Co.
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Mounds Station - Oklahoma Pipe Line Co.

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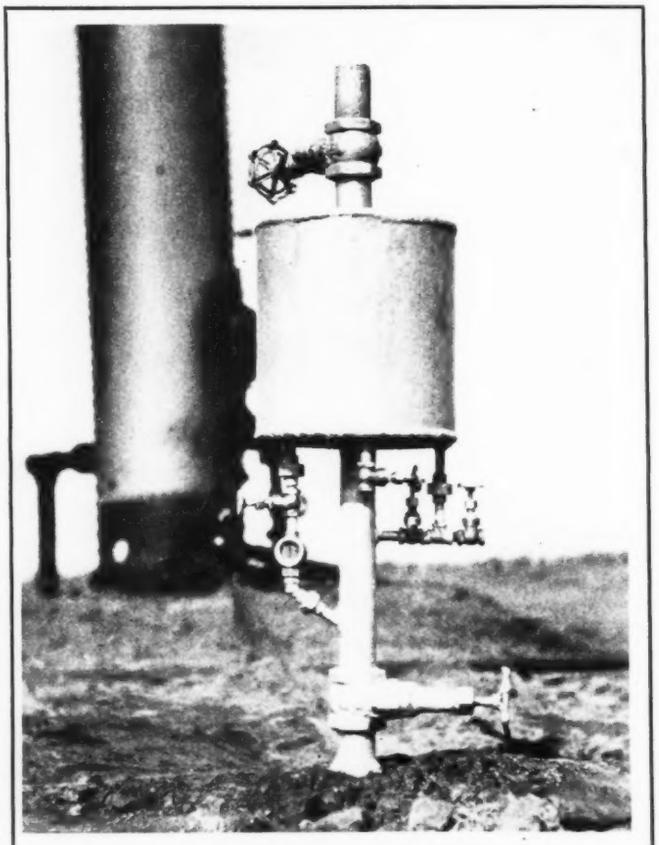
of some other maker's product.

The reading of those test results is a matter of no skill; any field treater can determine for his own satisfaction which of the compounds is the best for the particular emulsion.

The application of the treating compound is a simple mechanical matter. It is generally fed through a lubricator, of which the sketch below is typical.

If a well is being pumped on the beam, a suitable and positive chemical feed is that furnished by a force-feed lubricator, whose plunger is actuated by a connection rod tie into the beam. The lubricator is set on the derrick floor and the stroke of the walking-beam works the pump so that chemical is pumped into the flow line right at the point where the oil leaves the well. An adjustment on the lubricator makes it possible to control the amount of chemical fed.

The lubricator illustrated on this page is generally connected on top of the flow line from the well on the common carrier from a group of wells. The location for this equipment is as close to the well as possible, so that the compound be given plenty of time to mix with the emulsion during its travel to the gun barrel tank or other heating agents at the plant. The longer time it has to mix and the greater mixing given the chemical, the better will be the results occurring from its application.



Lubricator for injection of chemical in treating oil.

***Bottom Hole Treatment***

Get your chemical into the emulsion as soon as possible. A still better practice than that of putting the treating compound into the flow line is to have a pressure lubricator installed on the derrick floor, and with the aid of natural gas, lubricate the chemical to the bottom of the hole. Emulsions are generally caused by water entering the hole and being emulsified with the oil by various factors like gas, ragged tubing and cups, and worn pumping barrel valves. Then if the trouble starts down below, this is surely the place for the chemical so that it might enter the turbulence as soon as possible and at the best spot. If used in this manner, the chemical is rather a preventive than a cure. And there can be no doubt as to which state is to be preferred of those two just mentioned.

Having decided how and where to feed the chemical, the next question is the rate of feed. Start by putting in too much chemical. The bench centrifuge tests will give enough idea as to how much chemical will be necessary. From that point onward all that is necessary is frequent shaking out samples and close comparison of the results thus obtained. By this means the chemical feed can be adjusted to a nicety.

It is a small and simple matter to gauge accurately how much of the treating compound is necessary, but it is a sad commentary that in many cases this method of treatment is used with great carelessness, resulting in high treating costs. For this there is no excuse whatever.

Having once determined what the rate of feed should be, there will be few occasions indeed when this feed will have to be increased. During the day, less chemical is used than during the night, and more is used in the winter than in the summer. But having determined the worst state of cut-oil that any well may produce, the rate should be promptly fixed and reduced from that stage onward. It should be cut down when the effects of the sun begin to be felt; a warm day will cause less chemical to be used than one that is overcast even when the clouds might have that silver lining.

As the well ages so does its water-oil ratio increase. Water encroachment is commensurate with the depletion of the oil sand, and while this increase in the volume of water pumped or lifted means less oil income and higher lifting costs to the producer, yet he has what consolation the fact affords him, namely, the greater the volume of free water (salt or sulphur) accompanying his oil production, the easier it is to break down the emulsion.

It is when a well first shows signs of water encroachment in the hole that the tightest and toughest emulsions are encountered. It is here that all the skill and treating knowledge available are welcome and wanted.

***Gun Barrel Tanks Efficient***

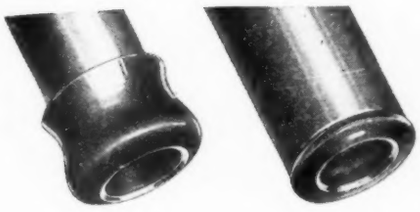
First decide how tough the B. S. is, then decide the manner to be adopted of treating the cut-oil, what kind of plant should be erected, and what chemical should be employed.

It is almost a certainty that both heat and chemicals will have to be applied to the recalcitrant fluid. That being agreed to, the question is how will heat be applied? The most common method is that of the gun barrel. This is a vertical tank (which should be insulated so as to retain its heat) of one or more rings higher than the stock tanks into which, by gravity flow, will go the treated oil, which is held until passed and bought by the pipe line gauger.

Such a gun barrel is shown in accompanying sketch.

Production flows to the gun barrel tank as a result of the lifting system used at the well and goes up over the top of this tank, thence down the middle of the "boot." At an established distance above the bottom of this receiving tank, the incoming fluid is distributed over a considerable area of the tank by headers or baffles, so that the cut-oil may not rise in columnar fashion to the top.

For some two-thirds the area of the gun barrel, it is filled with salt water which is maintained at an established and uniform temperature by means of steam coils set about



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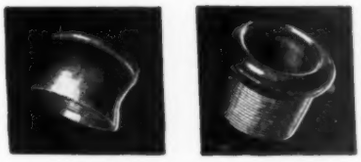
IF YOU are particular to specify "Colona Protected Pipe", you are certain to receive threaded pipe as clean and perfect as the day it passed the inspector's table in the pipe mill.

Colona is the only pipe thread protector which gives 100 percent protection both to threads and the ends. The distinctive bell shaped lip of the Colona absorbs the most severe punishment which would otherwise mushroom and burr the finest pipe.

Colona Protectors are used by most of the leading pipe manufacturers, but as a precaution, it will pay you handsomely to specify "Colona Protected Pipe" in your future pipe requisitions.

**PITTSBURGH SCREW & BOLT CORP.**
Colona Division
PITTSBURGH PENNSYLVANIA



**COLONA PIPE THREAD PROTECTORS**

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12 inches above the tank floor. Keep the intake steam valve wide open; pinch down in discharge valve to get better heat transference.

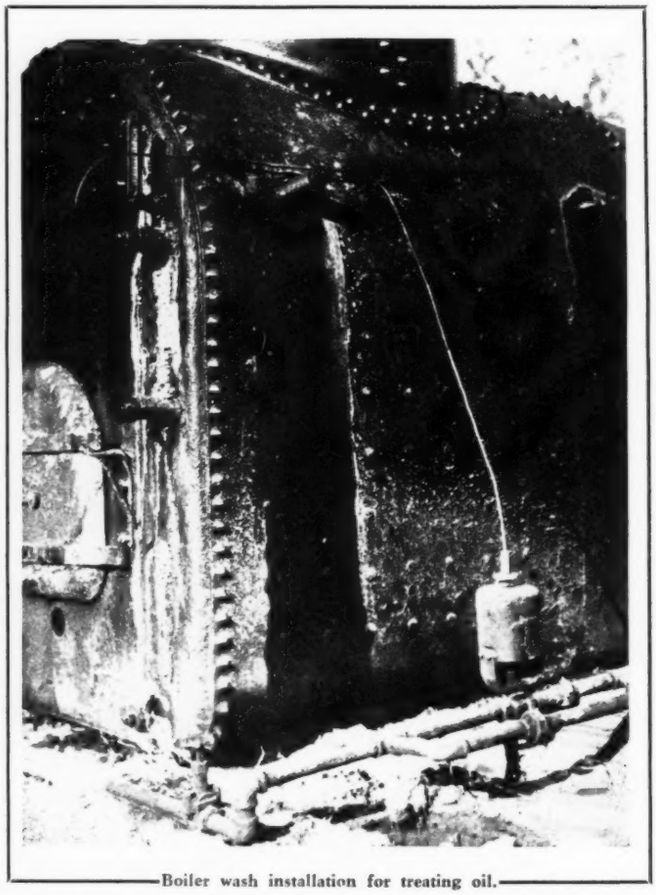
As the oil descends the Boot (a riser of pipe whose diameter is several times that of the incoming stream; for a 4-inch flow line a 20-inch Flume or Boot is common. The production descends this funnel, emerges into the tank through the holes set for that purpose about 24 inches above floor level. Spread over the tank by spreading devices) the cut-oil rises through the heated mark of salt water, is thereby heated and washed, and, if sufficient chemical has previously been fed to the production, a third reaction, that of heated chemical effect, transpires.

This three-way treatment, heat, wash and chemical, will do the trick. That rising to the top of the fluid level in the Gun Barrel will be pipe line oil from which all or most of the emulsion has been separated. As for the B. S., it has been broken down to its two component parts of oil and water. The latter stays behind in the wash; the former returns to join the free oil. The oil gravitates to the stock tanks; surplus water is bled off the Gun Barrel by an automatic syphon, which maintains a constant wash level, once set.

Another variety of heating agent is the boiler-heater. This is some old boiler which is no longer to be trusted with the task of raising steam. For the work of heating cut production to some such temperature as 100 degrees F. or 120 degrees F., this scrap material is well suited.

A level of water is kept over the flues so that the oil may not be burned; once cut oil is seared, it is beyond redemption, and of no use to market. Great care should be exercised at all times to see that the oil and the flues are separated by water.

The oil stream is carried over this water, heated, then permitted to rise through the dome of the boiler, thence into a settling tank. The purpose of the latter receptacle is to take care of the water separated from the broken down emulsion and at the same time free water raised with the oil.



Boiler wash installation for treating oil.

Can cut-oil be treated without chemical or heat aid? The answer is—very seldom. Under certain conditions pressure or vacuum has destroyed the emulsion; at others, the sun has done all the work.

Electrical dehydration has met with unusual success in many localities.

It is quite possible to use heat alone and produce pipe line oil from some mess of emulsions, but the cost is prohibitive. No, not the cost incurred through excessive fuel, and equipment depreciation, the loss is in the gravity lost. One degree A. P. I. reduction in gravity may mean a difference of 3 cents per barrel. In a 500-barrel shock tank, this loss of income would amount to $15.00.

On the other hand, if chemicals were used, the temperature could be greatly reduced (with a consequent saving in fuel cost and plant depreciation), evaporation losses stopped and gravity maintained.

| | | |
|---|---|---|
| Gain from increase in gravity..... | | $15.00 |
| Chemical cost treated oil, 500 bbls. ..... | $7.75 | |
| Reduction in fuel and depreciation costs ..... | | 1.00 |
| | $7.75 | $16.00 |
| | | 7.75 |
| Net Gain ..... | | $ 8.25 |

A higher price differential of 5 cents per barrel rather than 3 cents would see income increased $18.25 per day on a 500-bbl. production of pipe line oil.

It is sound economy to cut down on temperatures used; this great heat is expensive in several ways. To those enumerated can be added excessive corrosion of all piping and metalwork from salt evaporation.

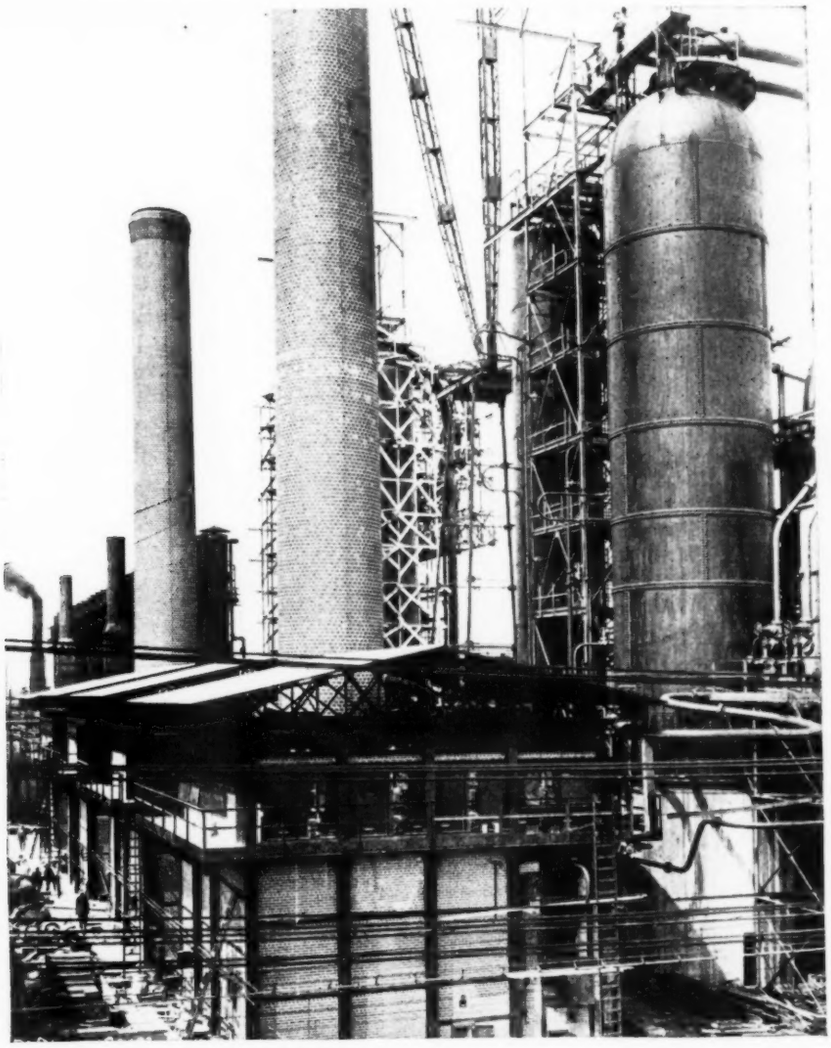
In the absence of high temperature, chemicals are a welcome aid in handling cut oils. The chemicals may be easily regulated, are not detrimental to the crude oils handled, nor to equipment, and in many cases they break up completely very difficult emulsifications.

Chemicals in use today are the products of manufacturers who have been in the game for several years, and are to be depended upon for consistency of quality, generally. Service men out of the factory are available at all times to help iron out some obstacle and the service is well worth using.

At this stage in the oil industry when more and more of the work is being done along sound engineering and chemical lines instead of the old-time method of rule of thumb, it is timely for all producers to look to their emulsion troubles, and use methods of treatment based on sound engineering and chemical practices arising out of sound past knowledge and experience.

There is nothing so unsightly as B. S. smeared all over a lease or on the banks of some creek. The stain at one time represented good money; it now tells of good money thrown away without any reason except that of ignorance or lack of treating knowledge.

There is no excuse for treating ignorance today among those men who handle production. There is no copyright about the methods used. They are open to all, and the knowledge will be gladly distributed. Many men will be willing to co-operate on any knotty problem.



# 28,000 Barrels Capacity

Two 14,000-barrel Foster Wheeler, two-stage distilling units are shown under construction. These units will process 28,000 barrels of Mid-Continent crude per day, recovering to rigid specifications, as many as eight overhead products and flux bottoms.

The knowledge necessary to design, build and place in operation such units, is the result of years' experience in refinery construction throughout the world. Foster Wheeler oil refinery equipment has been supplied to more than twenty foreign countries.

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## *Record-Breaking Crowds Attended*

# Seventh International Petroleum Exposition

THE International Petroleum Exposition at Tulsa, Okla., October 4-11, celebrated its seventh and last session until May of 1932 by breaking its past records of attendance, international participation, sales, and fuller representation of the oil and gas industry as a whole.

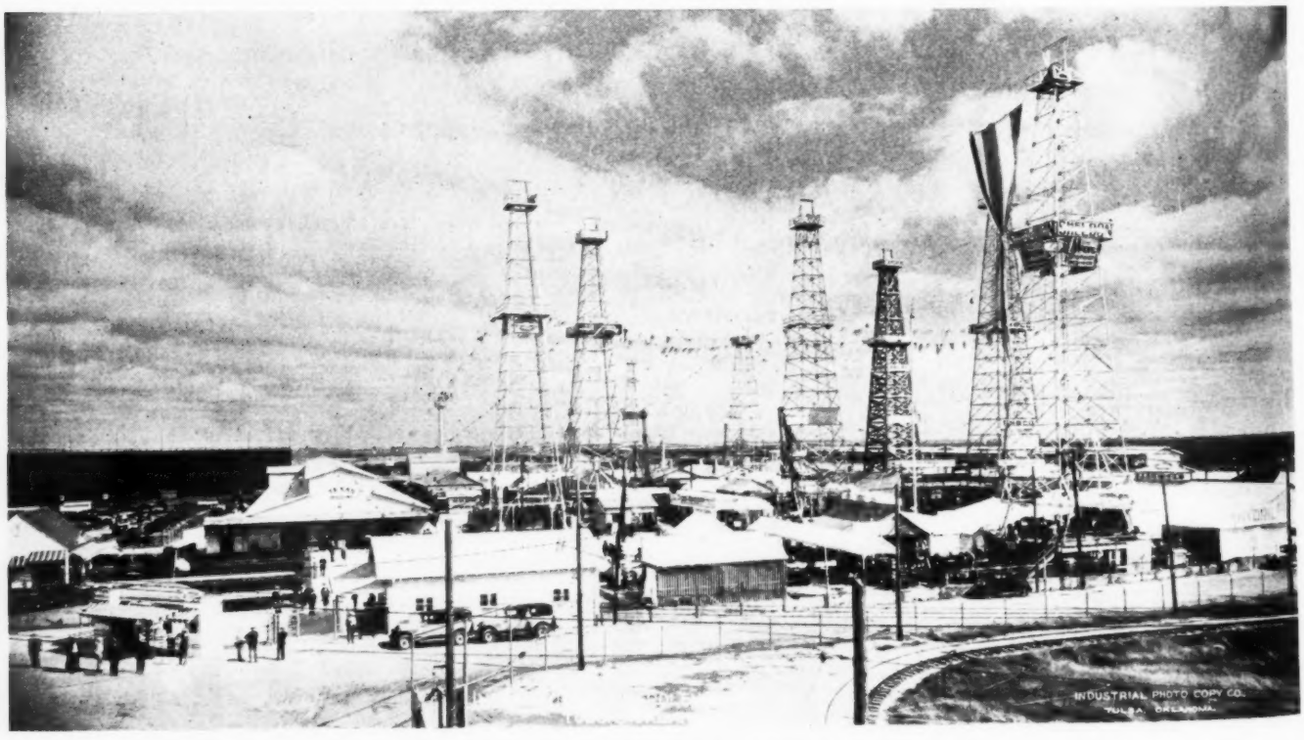
If a good start means anything, the oil show was sure of its triumph on the opening day, when two members of President Hoover's cabinet occupied the speaker's stand. These were Robert P. Lamont, Secretary of Commerce, and Col. Patrick J. Hurley, Secretary of War. Edwin B. Reeser, president of the American Petroleum Institute, and Henry L. Doherty, president of Henry L. Doherty Company and father of the proration idea, very appropriately rounded out the first-day's ceremonies. William G. Skelly, president of the exposition, gave the keynote of the eight-day convention of "men, methods and machinery." The attendance figure reached 151,000, passing the mark set in 1929 by a margin of more than 25,000, and this in spite of rain and threatening skies during the early days. A trusted indicator of the wide appeal of the oil show is the report on overflow Pullmans called into service. This report, as submitted by A. F. Winn, Skelly Oil Company, and chairman of the special trains committee, shows that from the great gathering point of St. Louis the number of these cars reached 51, bringing the total for the United States, Canada and Mexico to 145 special Pullmans. The regular coaches were found to have increased proportionately.

Wm. B. Way

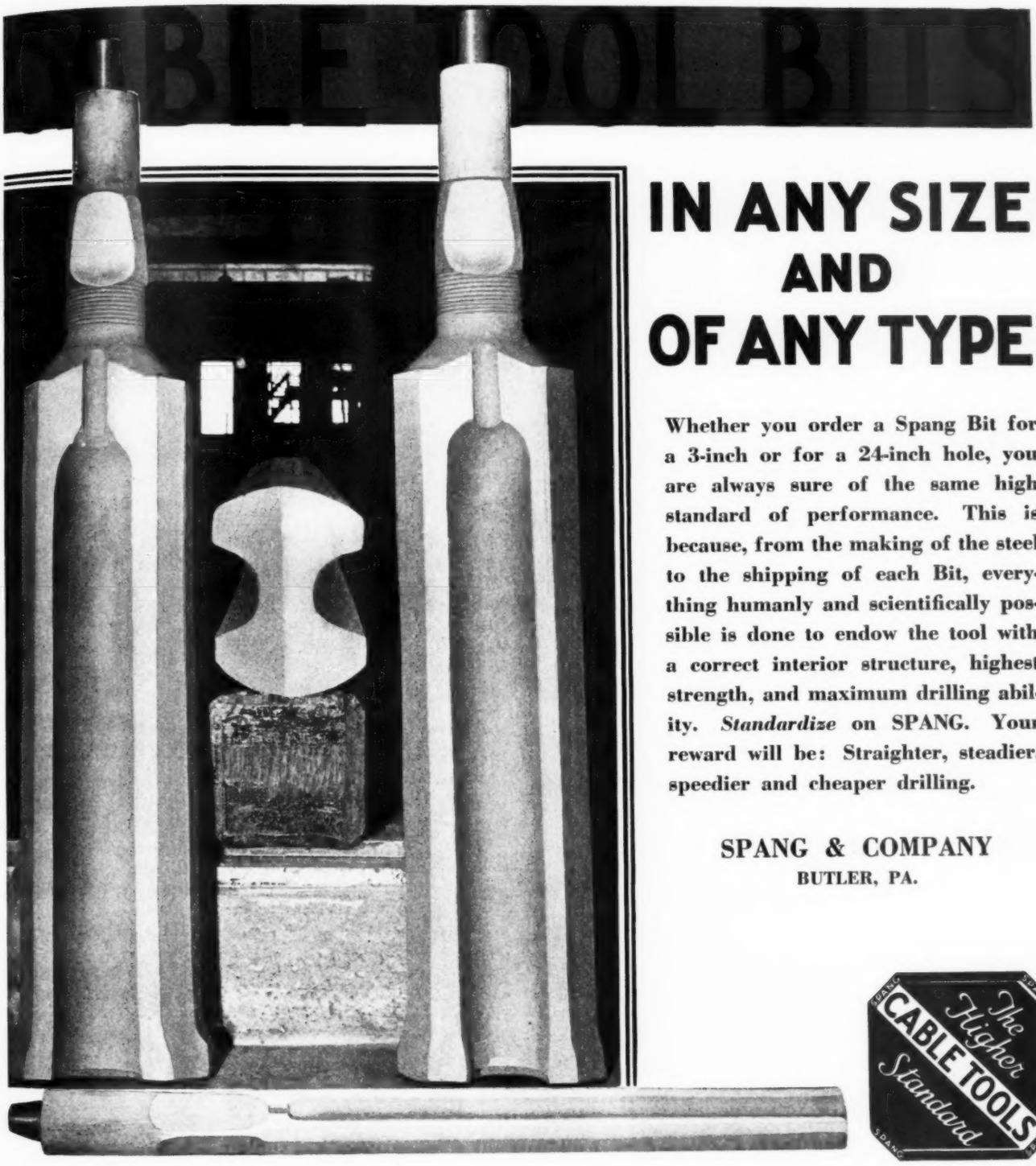
It is significant that there were seventy directors of the American Petroleum Institute attending the Oil Show, and a like representation of the petroleum division of the American Institute of Mining and Metallurgical Engineers.

The American Society of Mechanical Engineers, petroleum division, under the leadership of officials of the national organization, and W. G. Heltzel, executive chairman of the petroleum division, held their annual meet at the exposition grounds where they sponsored the presentation of an automatic pipe line pumping station.

The international aspect of the exposition was brought to the fore this year by unprecedented activity on the part of the foreign delegates. Nations represented were: Venezuela, Colombia, Mexico, Argentine, Canada, England, Scotland, British West Indies, Burma, Poland, Roumania, Russia, Germany, China, Japan, France, Holland and Egypt. A delegation of special interest was that of the fourteen students sent from the Technische Hochschule of Berlin, Germany. It was the consensus of opinion that, due in large measure to the capable direction of General Manager Wm. B. Way, the show was one of the most successful expositions oildom ever witnessed.




General view of the Exposition Grounds.



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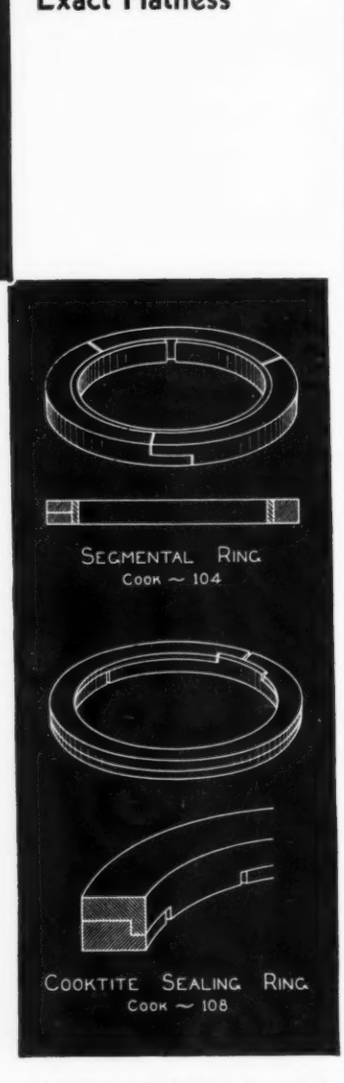
Less Cylinder Wear
Permanent Resiliency
Longer Life
Equalized Tension
Exact Flatness

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The twenty-five per cent increase in the size of the Oil Show plant this year made possible a full representation of the marketing and refining branches in a new building extending from the Oklahoma structure. A still more recent structure, the California building, took care of the overflow.

For the first time in the history of the Exposition, all of the exhibitors, numbering close to 400 in the contracts and standing for about 1,000 manufacturing and supply houses, agreed on the verdict that the 1930 Exposition surpassed all shows that in the past had been planned for the benefit of the petroleum or allied industries. It was generally agreed, also, that sales during the 1930 Exposition were even greater than in 1929 when an estimated figure of $6,000,000 was set up. One exhibitor alone said that during the 1930 show eighty-five contracts for his wares were signed at his booth.

General Manager William B. Way and his assistant, Victor Shenk, announce that more than 100 exhibitors' contracts are already signed for the 1932 event.

## Production Problems in the California Fields Discussed at the Los Angeles Meeting of the A. I. M. E.

DUE to the large attendance at the fall meeting of the Southern California Section of American Institute of Mining and Metallurgical Engineers held in Los Angeles on October 17, the technical sessions were held in the Biltmore Hotel instead of the California Oil and Gas Association rooms as originally scheduled. There were 214 registered for these meetings, while 250 members attended the dinner and the night session held at the University Club. Besides the reading of several papers of general interest that were also delivered at the Tulsa meeting, considerable interest was shown in those pertaining particularly to California operations, and the reading of these was followed by discussions that were very constructive. The meeting was under the direction of L. L. Brundred, associate chairman of the Petroleum Division of the A. I. M. E.

The various methods of dehydration were touched upon in a Microscopic Study of California Oil-field Emulsions by Mahmood Abozeid of Cairo, Egypt. Many microscopic photographs were shown to illustrate the work and the paper, together with a discussion prepared by the Petroleum Rectifying Company, confined its scope to laboratory treatment.

In speaking of Bottom Hole Beaning, W. A. Clark, engineer for The Texas Company, gave a number of blackboard illustrations showing the effect that the use of beans placed at the bottom of the well had had on both increasing and stabilizing production and in decreasing the gas accompanying the oil. He cited the three kinds of bottom hole beans that were applicable—the fixed type, the adjustable type and the removable bean—and expressed his opinion that the removable kind was probably the best under present conditions. In the discussion following this paper it was evident that some considered the bottom hole bean suitable for wells on gas lift but as questionable for service with naturally flowing wells where the prevalent method of putting the bean in the flow line had been giving satisfactory results.

The waters in the two most prolific zones in the field, the Meyer and the O'Connell, were discussed in detail by D. K. Weaver, petroleum engineer for The Texas Company, in his paper on the Encroachment of Edge Water in Santa Fe Springs. The Meyer zone has a maximum thickness of 700 feet and is encountered at a depth of approximately 4,100 feet. The O'Connell zone is divided into three parts and has a total maximum thickness of 775 feet and lies at

about 6,400 feet. Maps showing the waters of both of these zones were presented together with typical logs of wells producing from each. In regard to the Meyer, it was stated that there is "no evidence that these encroaching waters are acting as a water drive to increase production in the top structure wells" while with the O'Connell zone it seemed "probable that the high water head is driving the oil up structure in such manner that top-structure wells will enjoy a much greater recovery of oil" from the lower part of the zone.

An apparent reversal of normal oil field history was shown to be evident by the Water Problems of the McKittrick Field as presented by Joseph Jensen, chief petroleum engineer, and J. B. Stevens, petroleum engineer, of the Associated Oil Company. After 30 years of operation, the present conditions and direction of change in this field are most interesting; the curve of oil production is remarkably flat while the curve of water invasion (after reaching an appalling height) has shown a definite reversal and has been declining for ten years. The early records of the field showed (1) fresh surface water; (2) an intermediate sulphur water below the top oil sand; and (3) bottom salt water. The authors explained the depletion of the first two waters, but felt that it was not clear why the bottom salt water should diminish. Submergence in the field is now difficult to obtain and fluid levels have dropped over 200 feet. In concluding, it was stated that the "future of the McKittrick field will depend solely on the behavior of the bottom and edge salt water" and that the field should now perform in the normal manner with all top and upper waters eliminated.

The definite location of edge waters in the productive horizons of the Ventura Avenue Field has been used to advantage in drilling wells to different depths by the Associated Oil Company on its acreage. The details of the methods used were described in a paper on the Development Program of a Portion of Ventura Avenue Field, which was prepared by Joseph Jensen and F. W. Hertel, production engineer of that company. The water is plugged off at the bottom and production taken from above it for one class well; and it is cased off and production taken from below it for another class. The same method can be continued with added depth whenever the development of the deeper formations become necessary.

The Control of California Oil Curtailment was discussed by R. E. Allen, assistant to the California Umpire in the afternoon session, while the Unit Operation Proposal for Kettleman Hills Field was outlined by R. C. Patterson, supervisor for the U. S. G. S. in the evening. Discussion on the latter was led by T. E. Swigert, general superintendent for the Shell Company. Prof. J. F. Dodge read the paper on Economic Aspects of Utilization as prepared by J. E. Pogue, consulting economist of New York.

C. V. Millikan, chairman of the Petroleum Division of the A. I. M. E., introduced the several guests from other parts of the country, among whom were H. Foster Bain, secretary of the Institute from New York; George Otis Smith, director of the U. S. Geological Survey, and J. M. Lovejoy, president of the Mexican Seaboard of New York.

During the meetings, four papers previously read at the Tulsa meeting were presented and discussed by the members present. These were: Development of Casing for Deep Oil Wells by F. W. Bremmer of Spang, Chalfant & Co., Pittsburgh; Properties and Treatment of Rotary Mud by Hallan N. Marsh, production engineer of the General Petroleum Corp.; Velocity of Flow Through Tubing by E. L. Davis, production engineer for the Texas Company, and Effect of Edge Water on the Recovery of Oil, by H. H. Wright, formerly of the Gypsy Oil Company.

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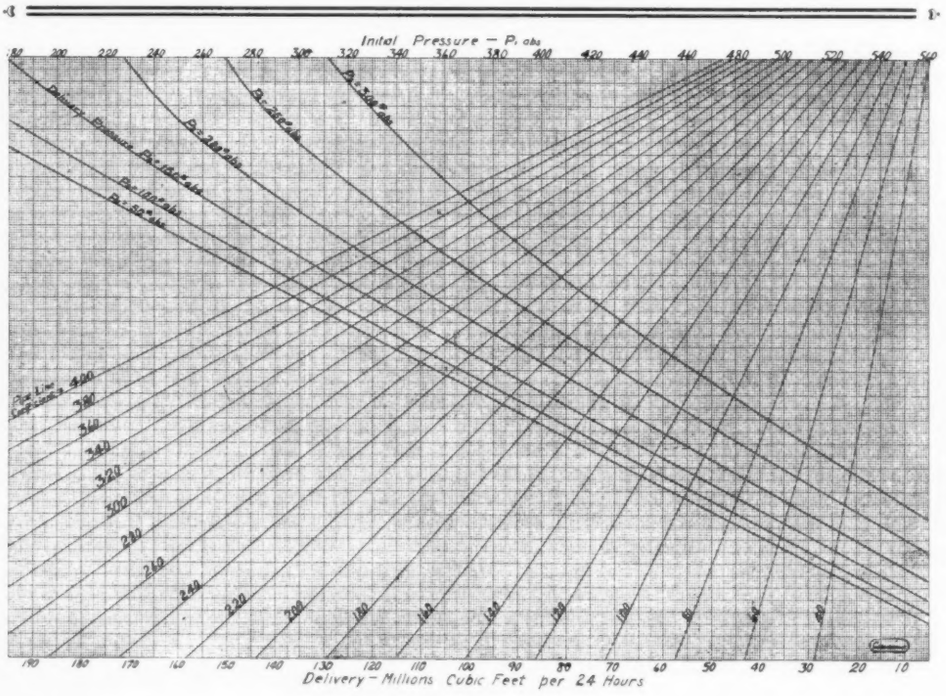
# Gas Flow Charts *for the* Calculation *of* Main Line Capacities

*By* M. V. COUSINS, *Engineer, Magnolia Gas Co.*

CHARTS for the calculation of pipe line characteristics have been presented in numerous forms in the past. Many of these, however, have been hard to read, complicated to use, or otherwise objectionable from the viewpoint of practical use. The charts herewith presented contain no radical change from the greater percentage of those published in the past. The form, however, is somewhat changed and simplified, so that there are as few moves to be made as possible to obtain the desired results with a fair degree of accuracy. In making up these charts the calculations were based on the results of metered flows in larger main lines at pressures from 100 to 450 pounds. It is believed that they will be found correct within a small percentage for the usual operating conditions for main lines in the southwest. Corrections could be applied for variations in temperature, gravity, etc., if these factors varied greatly from the average, but in general these variations cause an error less than the accuracy of calculations of this kind.




Three major problems are usual to pipe lines. First, with a given line to obtain one factor when the other two are known of inlet pressure, outlet pressure and volume of delivery. Second, to design a line for certain conditions of inlet pressure, outlet pressure and delivery. The third problem, really a division of the second, is the calculation of telescopic and loop lines.

The solution of these problems by the charts illustrated will be taken up in the reverse of the order mentioned. In the calculation of telescopic lines the various lengths of different sizes must be reduced to an equivalent length of one size. The theory of equivalent lengths is stated in the equation:

$$L_1 = L_0 \quad D_1/D_0\ 5⅓$$

where $L_1$ is the equivalent length of any pipe of given length $L_0$, and diameter $D_0$, in terms of any other diameter $D_1$. The total equivalent length of a system is the sum of the equivalent lengths of the lines that make up the system.

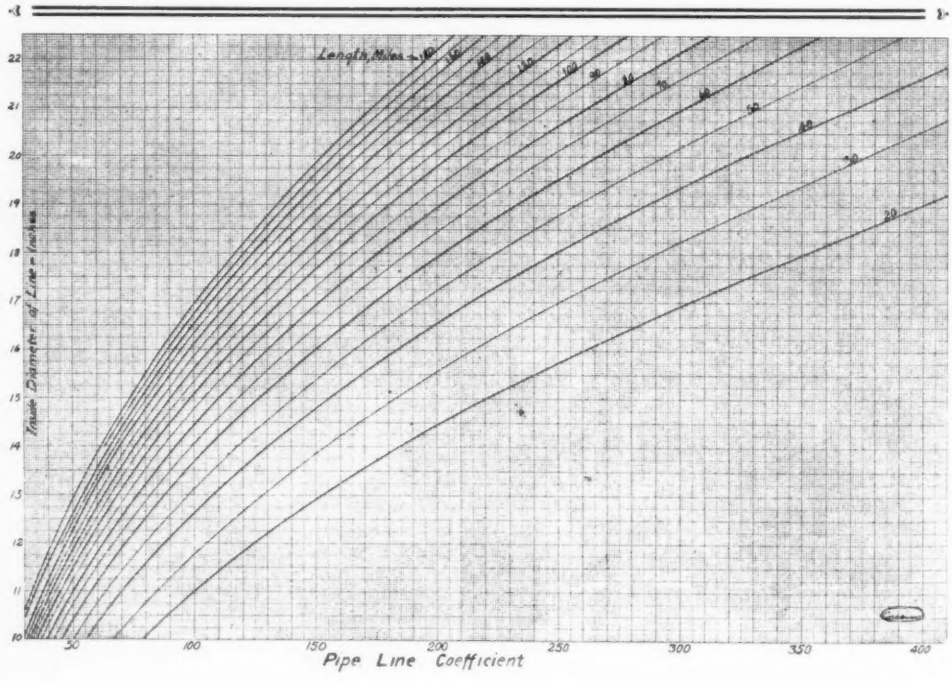



Chart No. 1 is for determining the equivalent lengths and gives the 5 1/3 powers of quantities from .5 to 2.0.

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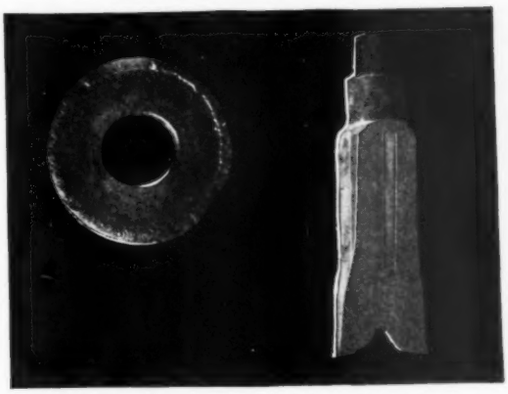

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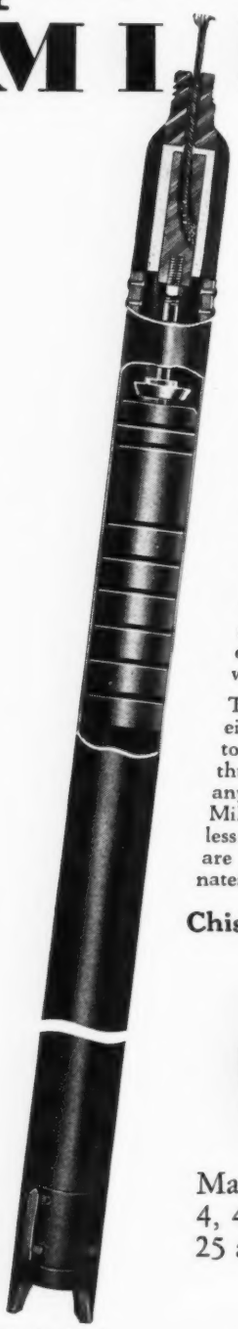

YOU can equip your Miller Sand Pump with the type bottom to exactly fit your requirements. One tool with four type bottoms to give utmost efficiency under all conditions.

Speed in cleaning out is made possible when you use a Miller Combination Bailer and Sand Pump, because you can use a 25 or 30-foot barrel. As illustrated, the wire line has direct connection with Plunger, eliminating a rod, enabling use of a longer pump in the well.

The Plunger is made 18 inches long with eight water courses permitting the fluid to seal the valve on top of the plunger, thus creating a greater suction than in any other pump made. The barrel of the Miller Sand Pump is of National Seamless Steel Tubing and all of the other parts are of the finest grade of steel, which elimnates any leather washers. Write for folder.

**Chisel Bottom** **Bailer Bottom**

Made in diameters of 2½, 3, 3½, 4, 4¼, 5, 5½ and 7 inch and 20, 25 and 30 foot lengths.

*For sale by leading supply houses everywhere*

**Regular Sand Bottom Shown in Pump**
Patented
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No. 1370340
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No. 1523604

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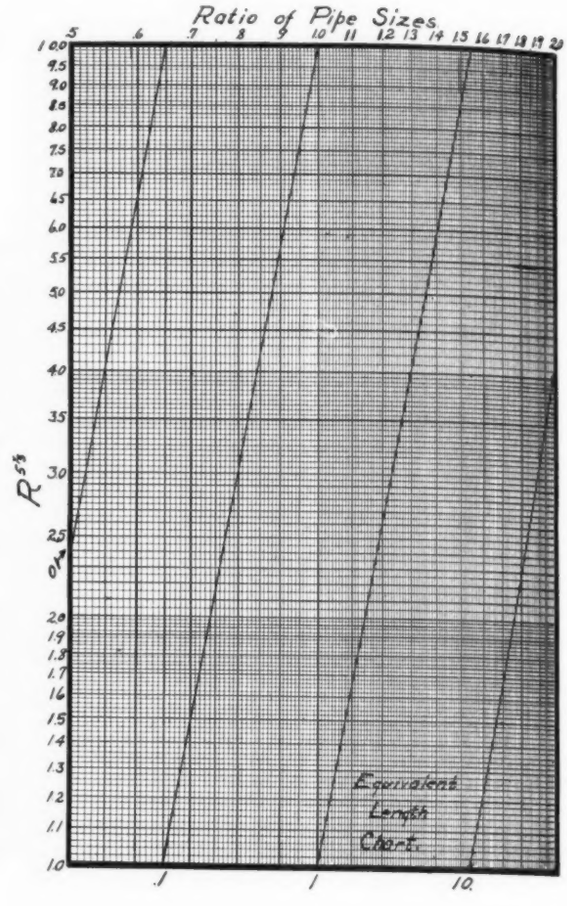


In resolving a telescopic line it is only necessary to get the ratio of diameters $\frac{D_1}{D_0}$ and by means of the chart raise this to the 5 1/3 power. This is done by starting at the top of the sheet at and dropping vertically to the intersection of one of the diagonal lines. From this point move horizontally to the left margin where the significant figures of the 5 1/3 power will be found. It will be noted that at the lower ends of the diagonal lines there are the figures .01, .1, 1. and 10. These are multipliers for the powers on the left of the sheet and whatever power is found should be multiplied by the multiplier at the lower end of the diagonal used. This operation is rapid since it requires only moving the decimal point. By using the chart in this form the ratio of diameters raised to the 5 1/3 power is accurate to three figures. This power multiplied by the length of this size of line gives the equivalent length in terms of the diameter of line being converted to. For an example take a line with 30 miles of 15.5-inch I. D. and 40 miles of 17.5-inch I. D. pipe. Either size may be used for the equivalent length. If 17.5-inch is used, the equivalent length of 15.5-inch will be

$$\left(\frac{17.5}{15.5}\right)^{5\ 1/3} \times 30. \quad \frac{17.5}{15.5} = 1.13.$$

From the chart we find (1.13) equals 1.9. Then $1.9 \times 30 = 57$ miles which is the equivalent length of 30 miles of 15.5 inches in terms of 17.5-inch line. The total equivalent length of the line will be 40 plus=97 miles of 17.5-inch I. D. line. By noting that the size of line to be used for equivalent length is used

as the numerator in $\frac{D_1}{D_0}$ — no mistakes will be made in finding the equivalent length. The solution of loop systems will be shown later.

After obtaining the equivalent length of one size as shown above these factors are carried forward to chart No. 2 to obtain a pipe line coefficient. On this chart the inside diameters are plotted against lengths from 20 to 180 miles to give coefficients for the lines. By starting at the inside diameter of the line on the left of the chart and moving horizontally to the equivalent length (or actual length if only one size of line is used) then dropping vertically to the bottom of the sheet a coefficient will be found for this size and length of line. Using the above line as an illustration of this chart at an inside diameter of 17.5 inches on the left of the sheet and move to the right to a length (interpolated) of 97 miles. Then drop to the bottom of the sheet where a pipe line coefficient of 149 is found. This coefficient is carried to chart No. 3.

The deliveries with different inlet and outlet pressures and different values of pipe line coefficients are obtained from chart No. 3. On this chart there are four factors, three of which must be known or assumed. The most usual problem is the delivery for a given line under fixed conditions of inlet and delivery pressures. Using the above line as an example and the inlet and delivery pressures as 300 pounds and 100 pounds respectively, the method of finding the daily delivery will be as follows:

Start at the top of the chart at 300 pounds and drop vertically to the intersection of this line with the 100-pound delivery line. This point is carried horizontally to the right or left as necessary until it intersects the pipe line coefficient line. In this case move to the right to the intersection coefficient 149. Then drop down vertically to the bottom of the sheet where a delivery of 51.5 million for twenty-four hours is shown. It must be noted that this delivery reads from right to left instead of from left to right.

Reversing the process, to find the inlet pressure necessary for a certain delivery, start at the bottom of the chart at the delivery desired, move vertically to the pipe line coefficient, then to the right or left to the intersection with the line of pressure desired on the outlet end of the line, then upward to the top of the sheet where the absolute pressure necessary on the inlet end of the line will be found. To find the pipe line coefficient necessary for given conditions of inlet and outlet pressure and volume of delivery, start at the top of the sheet at the inlet pressure and drop vertically down to the outlet pressure desired and draw a line horizontally across the sheet through this point. Then start at the bottom of the sheet at the delivery desired per day and move upwards to intersect the line previously drawn. By interpolating between the diagonal pipe line coefficient lines the pipe line coefficient necessary will be found. The size of line necessary may be found on chart No. 2 from the length necessary and the pipe line coefficient.

Chart No. 3 will be found very convenient in the operation of main lines for the coefficients for several divisions or lines can be laid out on one sheet and solutions of problems of pressures and delivery for any line can be found with little delay. It will be noted that these pipe line coefficient lines are straight side materially in interpolating or drawing in values for lines already laid.

The solution of loop lines by this method is most easily performed as the coefficients lines of the different loop system may be added together to give a coefficient for the lines operating as a whole.


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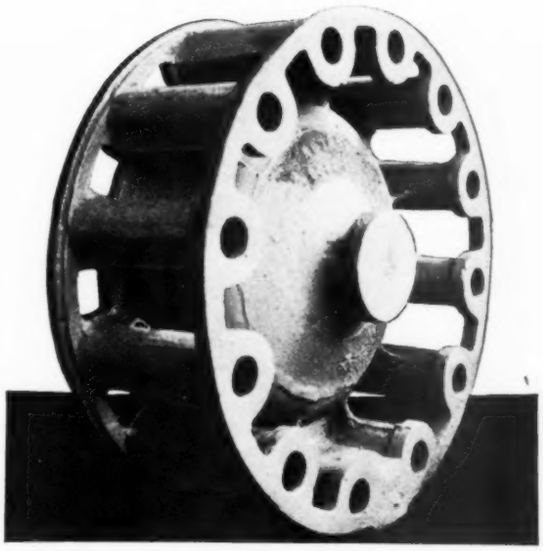

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***Saves Fuel, Oil, Piston Rings and Cylinder Walls.**

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# TIME *and* TROUBLE SAVERS

The Carter Oil Company at Seminole, Oklahoma, camp has two portable fire walls. These are mounted on wheels so that they may easily be moved to the location of any fire.

The walls are of galvanized sheet iron about ten feet high, with an additional sheet attached on hinges to further increase the height if desired. The attached wall may be raised from the back side, protecting the workers from fire.

In case of fire in any of the camp homes these fire walls are placed between the fire and the next structure to prevent spreading of the flames.

A simple method of locating a crankshaft break is to drain all the oil off, and after wiping dry, to chalk the crank with carpenter's blue chalk. By taping with a hammer any break in the shaft can be located with the naked eye, since the oil which has seeped into the crack will come out when it is being taped near the break. Oftentimes crankshaft breaks are hard to locate, and this is an easy and sure method.

A company is flowing a water well in the Holdenville, Okla., district with air. The well is 60 feet deep. One compressor drives the air down a one-inch pipe and the water up through the four-inch casing to the top of the ground where it enters a small tank through a spray on the top. After spraying into this tank it flows by gravity to a common reservoir.

A safer and more economical method of transporting the spent filter coke from contact filtration is to drop it in water and pump it away, rather than to haul it in a truck.

Many refiners find it more economical to treat the various fractions of gasoline separately rather than a finished blend. Usually the lighter fractions are free from gum forming constituents and require little or no treatment, while the heavier fractions are more difficult to treat. This procedure is especially advantageous for testing anti-knock gasoline.

Emergency repairs are sometimes delayed because the proper size socket wrench is not immediately available. This may be overcome by cutting a small piece of sheet metal to fit against one of the flat sides of an oversize socket and bending the protruding end outward. By using the shim in an oversize socket, it is frequently possible to turn the nuts with ease.

To start a nail in a place difficult to reach or drive, it is suggested to wedge the nail between the claws of a hammer. This is done by holding the point end and forcing the head of the nail against the neck of the hammer. By doing this the nail will be held while it is being started.

When using any of the numerous cleansing agents, such as gasoline, naphthas, etc., for cleaning leather belts, it is well to wind the belt in a loose coil and immerse it on its edge in the liquid and permit it to stand overnight. The next morning, stand the belt on its other edge for 10 or 12 hours. Most dirt usually loosens and settles to the bottom, and that which does not is usually readily knocked off by scraping or brushing. When dry, the belt should be lubricated with a dressing recommended by the manufacturer.

An oil company operating in the Seminole, Okla., field, has rigged up a one and one-half ton truck as a portable paint unit. The crew on this truck can paint an 80,000-barrel storage tank, including the roof and side, in one day, or two houses of four and five-room capacity with two coats each in one day's working time.

The truck carries a six horsepower gas engine and one 4½ by 5 compressor. One welded air container 15 (pipe) by 48 inches, and a four-gallon paint container. A number of hose are carried, of which, two are 200 feet three-quarter inch hose. Two spray guns and different length ladders complete the equipment. The working pressure maintained during operation is from 80 to 100 pounds.

The workmen use respirators to protect their lungs. These are equipped with removable dustproof filters and pneumatic rubber cushions for application to the face.

Two large jacks are used to raise the rear of the truck when the engine is being used to drive the compressor.

When batch agitators are used for sweetening gasoline it is found more economical and efficient to circulate the treating solution only, instead of a mixture of it with gasoline. A pump takes suction at the bottom of the cone and discharges over the surface of the gasoline through a perforated spider with holes so drilled that uniform distribution is obtained. The treating solution only is circulated, and the treating loss is minimized.

A counterweighted walk to the tank car from the loading rack is used for safety at the Tidal Refinery at Drumright, Okla. One of these is installed at each loading spot. Each walk is equipped with hand rails and so balanced that a minimum force is required to raise or lower it. When lowered to a horizontal position it is locked in place.

To reduce the possibility of swelling a dowel pin when driving it out or in, it is suggested to use a short accurate fitting and a short soft punch.

A water well at a pipe line station, located an appreciable elevation above the station site, caused considerable trouble due to breaking connecting rods. The head at the discharge outlet of the pump varied with the stroke from a vacuum of four to five inches to a pressure of five to 10 pounds. This fluctuation of pressure caused severe stresses to the rods and resulted in a constant breaking of these members. The trouble was relieved by using a spring loaded check valve on the discharge of the pump with the spring set for a pressure of 15 pounds, which resulted in maintaining a constant discharge pressure and reducing the stresses.

The residences in the Carter Oil Company camp at Seminole, Oklahoma, are of the portable type. A cable has been run over the roof at each end and firmly attached to an anchor placed in the ground.

The cable, which is of any old wire rope or cable ready for discarding, is for the purpose of preventing the rattling of windows and doors during heavy winds, and to make the structures more substantial.

*If you don't want a pumper, use AQUAGEL. Stops penetration of mud and water into producing sand.*

*AQUAGEL helps get all the oil. Reduces chances of cut oil. Saves money!*

HOW LONG WILL IT BE BEFORE YOUR WELL IS A PUMPER? • • • •

# AQUAGEL

## *guarantees that the production zone will not be mudded off . . .*

In all low-pressure fields there is great danger that the initial production (and ultimate production) of the completed well will be greatly impaired and reduced by the intrusion of mud and water into the producing zone. In some cases, the water filtered from the drilling mud has penetrated the oil zone to such a distance that the wells could never be swabbed in and the holes had to be junked.

When the mud is conditioned with AQUAGEL, the colloidal nature of the AQUAGEL guarantees a minimum penetration of mud and water. It will be readily flushed from the wall of the hole and the **total** drainage area will be available for production.

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*Milled Groove Screen's* remarkable ability to safely stand 8,000 feet of drill pipe, to increase production from 33⅓% to 100%, to stimulate low pressure wells, to avoid clogging with mud and sand, and to prevent sand cutting are reasons why this exclusive invention is used 'round the world by large and important oil companies.
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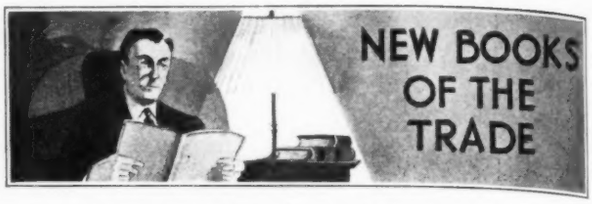


## Petroleum Mechanical Engineering

THE American Society of Mechanical Engineers recently has published "Petroleum Mechanical Engineering." This book is a valuable contribution to the technical literature of the petroleum industry, as it contains copies of all papers presented at the First National Meeting of the A. S. M. E. Petroleum Division held at Tulsa, October 6-8, 1930. Written by engineers of recognized standing and authorities in their respective fields, these papers cover a wide range of engineering subjects pertaining to oil pipe lines and the transportation of oil, refining, natural gasoline, and oil production equipment and practice.

Activities of the A. S. M. E. in the petroleum industry are also outlined. Copies of this publication can be obtained from the American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York. Price, 50 cents a copy; to foreign countries, 60 cents.

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## Naylor Pipe Bulletin

NAYLOR PIPE COMPANY of Chicago, Ill., has issued Bulletin No. 30-2. This is a neatly-assembled, well-illustrated bulletin, containing much engineering data besides a complete description of Naylor pipe and its qualities.

The engineering data, which is published for the first time, consists of reports made by Melvin L. Enger and W. M. Lansford of the materials testing laboratories of the University of Illinois. Tests on internal hydrostatic pressures, external hydrostatic pressure, cross bending, crushing, cold bending and longitudinal tension and compression are given.

Analysis of various sizes of pipe line costs is given with list prices of Naylor pipe. The company's domestic carloading schedule is printed on page 36.

This bulletin may be secured by writing to the company headquarters or to any of the branch offices.

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## New Lufkin Catalog

LUFKIN FOUNDRY AND MACHINE COMPANY, Lufkin, Texas, is now issuing a new catalog which, in addition to descriptions and illustrations of its products, contains interesting engineering data with blue print foundation plans that should be interesting to oil-field engineers and superintendents. The catalog will be in the mail within a few days.

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## Magee-Pfeiffer Bulletin

THE Magee-Pfeiffer Company, Chicago, Ill., has published a bulletin on the subject of "More Power!" The pamphlet describes the Magee-Pfeiffer clutches, which are offered in four sizes, and explains the working principles in illustrations. The introduction discusses how to meet the demand for more power and what you should demand in a clutch.

### New Ampco Books

TWO new booklets have been issued by the American Metal Products Company of Milwaukee, Wisconsin. The booklet on Ampco non-sparking tools, shows a complete line of tools, which in addition to being non-sparking, are claimed to give satisfactory service.

Uses of Ampco Metal, its features, physical characteristics and specifications are given in the other booklet.

### Cook's Graphitic Iron Piston Rings Booklet

C. LEE COOK MANUFACTURING CO., Louisville, Ky., has published bulletin No. 130, describing and showing its Cook's graphitic iron piston rings.

The booklet gives specifications, history, types, and many other important features of these rings. In addition an interesting discussion on the causes of cylinder and ring wear is given.

### New Dreadnaught Accessories Bulletin

THE Beaumont Iron Works Co., Beaumont, Texas, has published a new pamphlet covering Dreadnaught accessories, to be inserted in place of page 7 in the present catalog and folder on wire line guide, immediately preceding page 7 in the catalog.

### Podbielniak Apparatus Described

PODBIELNIAK Analytical and Research Laboratories of Tulsa, Okla., describes its improved fractional distillation analysis apparatus in a new bulletin. The company's commercial analytical and research laboratory and its consulting and research service is also described in this new bulletin.

### Cooper-Bessemer Bulletin

THE Cooper-Bessemer Corporation, Mt. Vernon, Ohio, announces that the 24-page bulletin, "New Type-10 Compressor Unit," is just off the press and is ready for mailing. The bulletin gives the latest information on the improved 100 B. H. P. single and 200 B. H. P. twin unit. A new compressor cylinder, a gas economizer and other field-proved features are shown and described, together with representative installations of this 2-cycle gas engine compressor.

### National Supply Company Catalog

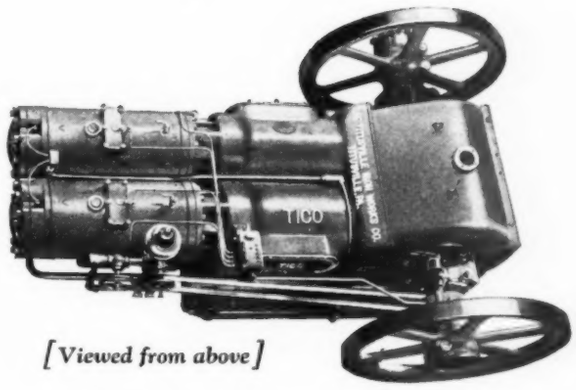
THE 1930 No. 40 general catalog of the National Supply Companies, Toledo, Ohio, has recently been distributed.

This catalog is one of the mose complete issued by any concern catering to the oil industry. Practically every kind of equipment from machinery, tubular goods, tools and supplies for oil, gas and water wells, to pipe line, natural gas, gasoline plant and refinery supplies are pictured, together with description and specifications.

The catalog, bound in a heavy blue cover, is more than one thousand pages in size.

The back part of the catalog is devoted to general information such as the material required to build rigs; history and origin of petroleum and natural gas, statistics, weights, pressures and measures.


"-extra heavy"




*[Viewed from above]*

## *Twin TICO Two Cycle Gas Engines*

**CYLINDERS are semi-steel with exceptionally large inlets and exhaust ports.**

**Two piece cylinder head for combustion chamber and removable water jacket—no blind pockets but quick and easy to clean.**

**Six rings—four in combustion chamber and two on pump, arranged so that leakage is impossible.**

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**Heavy Chrome-Vanadium crank shaft, fully counter-balanced and run in heavy duty Timken roller bearings.**

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TIW-80

*When writing* TITUSVILLE IRON WORKS CO. *please mention The Petroleum Engineer*

# *Laredo Refinery Makes* » » » » Anti-Knock Gasoline *from* Mirando Crude

*By* A. H. MAYO, *Refinery Supt.*

THE anti-knock qualities of Whirlwind gasoline, manufactured by the Motor Fuel Products Company at Laredo, Texas, originate in the crude oil processed in this refinery.

The plant has a capacity of 2000 barrels of crude oil per day. Both Mirando and Refugio crudes are run. The distillation units consist of a pipe still for topping the crude and for rerunning the pressure distillate and a cracking unit.

The increase in the compression ratios of most automobile engines manufactured during the past year has focused the energy of research chemists and engineers in the petroleum industry on the anti-knock properties of motor fuels. As the number of high compression engines increases the refiner is required to improve these properties of his non-premium grades of gasoline also, and when blending Ethyl Gasoline he finds it economical to use an untreated stock possessing the best possible anti-knock value.

Some refiners are fortunate in processing a crude which produces a gasoline of high anti-knock value, and some operate cracking units manufacturing such a product, however, the straight run gasoline from most paraffine and mixed base crudes, has a low anti-knock rating. A good deal of research work has been carried on to improve these properties of straight run gasoline. Work at Pennsylvania State College by M. R. Fenske and F. C. Whittemore shows that the various fractions of straight run Pennsylvania gasoline show considerable variation. These fractions can be separated by efficient fractionation. Recently some research work has been done to crack straight run gasoline and thereby improve the anti-knock value.

A. H. Mayo

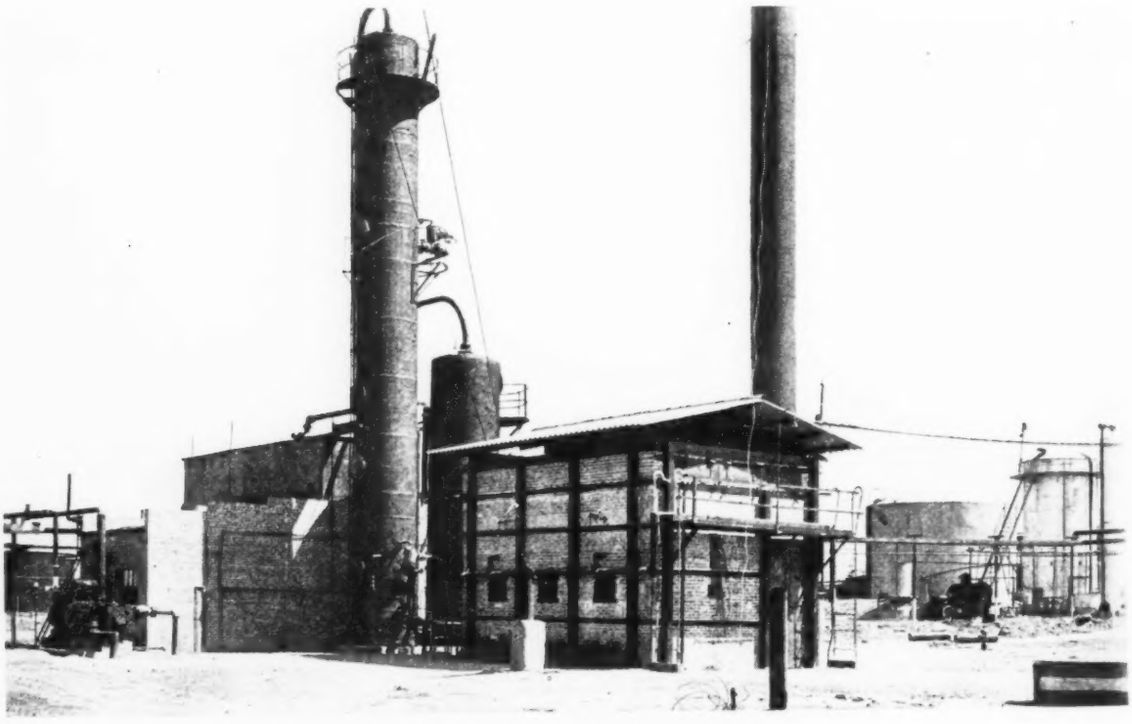
### *Mirando Crude*

This crude has a gravity of 20-21 A. P. I., and a sulphur content of about 0.3 per cent. The crude is charged to the cracking unit and cracked. The unit is operated under 240 pounds pressure and 810 degrees F. transfer temperature.

The operation yields from 60 to 65 per cent of finished gasoline having a 70 per cent benzol equivalent, and the treated product shows less than 10 mg. of gum per 100 C. C. The residue from the cracking operation is about 25 per cent of the charge and is sold for heavy fuel oil.

### *Treating*

The pressure distillate from the cracking unit is treated in a continuous treater with four pounds of 66 Be sulphuric acid per barrel, two pounds of which, or the first addition, is sludge acid; and then neutralized with caustic soda. The



Crude oil distillate unit at the Laredo refinery.

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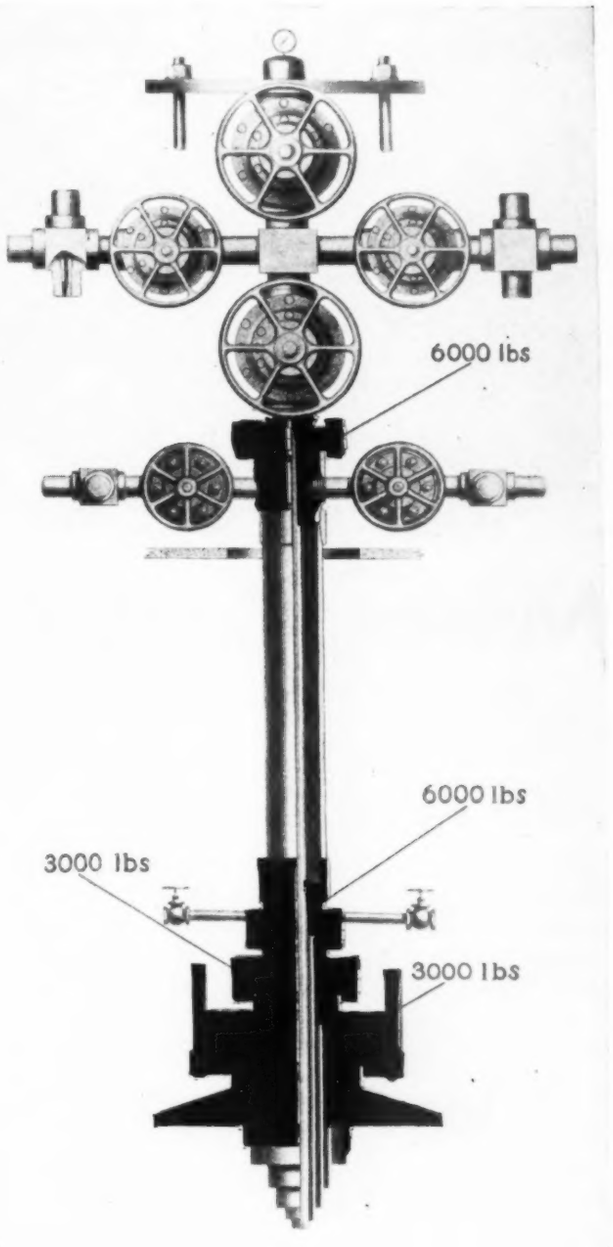
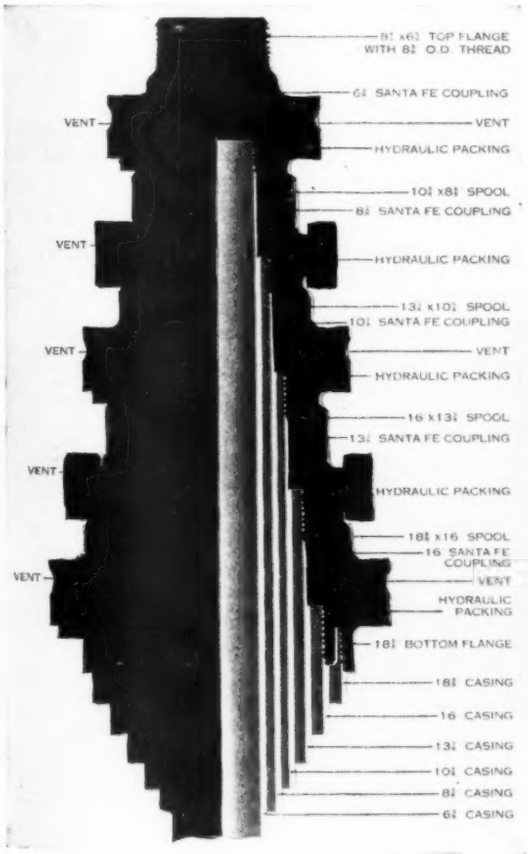
The flanges are hydrostatically tested to 3000 and 6000 lbs. so that you can safely use companion flanges or other equipment bolted to the head.

When casing is suspended, the capacity of the flanges is increased proportionately, resulting from the weight of the casing assisting the bolts. When several long strings of casing are suspended it is not unusual to double the capacity of the lower flange. This is not mere theory but based on sound engineering principles.

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For anticipated pressures of 2500 and 3000 lbs., and where several strings of casing are to be suspended, you can safely use 3000 lb. test on the larger and lowermost flanges and finish up with 6000 lb. test equipment for the upper flanges which are less loaded.

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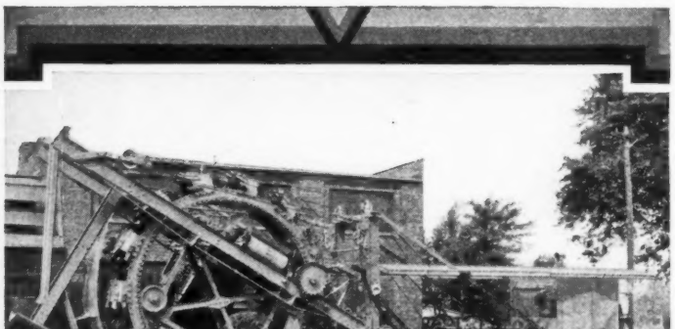

# MIGHTY MODEL 48

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6 Cutting Widths—22" and 24"; 26" and 30"; 37" and 40"

3 Cutting Depths—6½', 7½' and 8½'

**LIKE its brother Buckeye Pipe Liners within their respective service ranges, big, powerful, speedy Model 48 sets the pace in cutting the largest pipe line trenches now required.**

**That ability has not been suddenly or miraculously acquired, and it is not flashy, temporary performance. Instead, it is a thirty-year-old habit that will be attested by thousands of owners for whom these Buckeyes have cut hundreds of thousands of miles of trench.**

**Three indisputable facts prove beyond question that Buckeyes *have been* and *are* the preferred standards of leading pipe line engineers and contractors. *First*, more Buckeyes are engaged throughout the world's oil and gas fields than all other makes combined. *Second*, probably 95% of all major American cross-country pipe lines are laid in Buckeye-cut ditches. *Third*, many large pipe line contractors use them exclusively, while others employ them in large numbers.**

**Our new catalog, "BUCKEYE—The Pipe Liner", tells all about "*the ditchers that meet* all *pipe line requirements*". It contains detailed specification, mechanical and performance data of vital interest to every prospective pipe line ditcher owner and user. Your copy will be sent for the asking.**

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treated distillate is then rerun in the pipe still. The finished gasoline becomes perfectly sweet to the doctor test after 24 hours in storage.

On account of the very high anti-knock value of this finished product it is called concentrate, and used for blending with straight run gasoline from the crudes to improve their anti-knock value.

Properties of Whirlwind Concentrate:

| | |
|---|---|
| Gravity | 45 API |
| Benzol equivalent | 70-80 Per Cent |
| Color (Saybolt) | 30 Plus |
| Initial B. P. | 90-100 Degrees F. |
| End Point, max. | 420 Degrees F. |

***Refugio Crude***

A 46-degree A. P. I. Refugio crude is also run at the refinery. This crude is topped in the pipe still, outlet temperature being 580 degrees F.

This yields about 50 per cent of straight run gasoline of 420 degrees F. end point, having a benzol equivalent above 50 per cent. It is sweet and non-corrosive, requiring no chemical treatment.

A kerosene cut of approximately 15 per cent is also made, and the 18 degree A. P. I. residue is cracked to gasoline and fuel. This operation yields about 50 per cent of the 420 E. P. gasoline having a 40 per cent benzol equivalent. The pressure distillate is treated with four pounds of 66 Be sulphuric acid, neutralized with caustic soda, and rerun in the pipe still.

***Boiler Plant***

Steam is generated in two 150 horse power water tubular boilers. As city water is used in the plant no treating is required. The condenser water is cooled in a modern type tower.

Electrical pumps are used throughout the refinery with steam stand by units.

***Laboratory***

A chemical and physical testing laboratory is located at the plant. One of the features of the equipment is a specially designed anti-knock test engine having a variable compression head, capable of operating under compression ratios from 3.2 to 8.2. A bouncing pin is used to indicate the knock. The temperature of the cooling liquid can be controlled to study anti-knock properties at various temperatures.

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## Industrial Paint Plant for Beaumont

SOCONY SPECIALTIES, INC., a subsidiary of the Standard Oil Company of New York, has begun the erection of a modern paint plant at the corner of Madison avenue and the K. C. S. railroad tracks at Beaumont, Texas. The plant, the main building of which is approximately 75 feet x 75 feet and three stories high, is expected to be in production about January 1st. A complete line of industrial paints, varnishes and enamels will be manufactured.

Socony Specialties, Inc., is a development of what has heretofore been the Standard Oil Company of New York Paint Department, which was established in the 1860's at Cleveland, Ohio, but subsequently moved to Long Island City, New York, where since 1875 a large plant has been in operation.

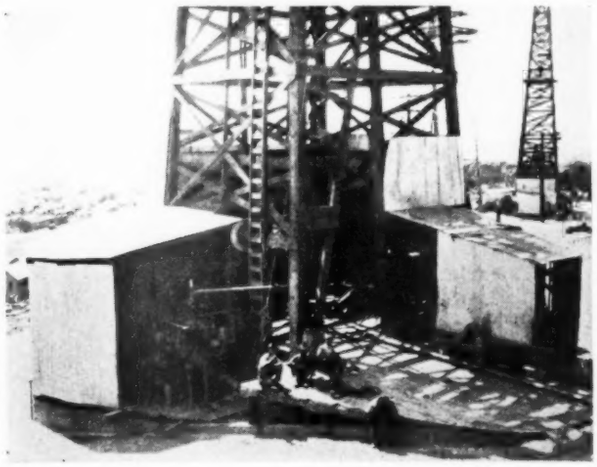
The business of Socony Specialties in the Mid-Continent and Gulf fields has increased to such a degree that officials of the company decided early this year that a plant more convenient to consuming points was advisable. The new Beaumont plant as at present designed will have a capacity of about 10,000 pounds of paint products per day. It will employ about 20 men. The building is so designed that it may easily be enlarged.

*When writing* THE BUCKEYE TRACTION DITCHER CO. *please mention The Petroleum Engineer*

## Ingenuity in Arrangement of Equipment Solves Problem of Drilling Small Plot of Land

WHAT is claimed to be the smallest lease in the world is shown in the accompanying picture. It is on a triangular plot made by the curving intersection of streets in the town lot district of the Signal Hill field and contains an area of approximately 1800 square feet.

The well shown is being drilled by the Magna Oil and Gas Company and is called Emblem No. 1. An electric rig naturally had to be used, since there is no room for boilers. The derrick is a 24-foot base with one side flush with one lot line. Two 25/65-horsepower variable-speed motors are used as the prime mover on the drawworks and



**The entire lease is shown in this picture. It is just a small triangle.**

rotary table and are compounded when pulling out. The two mud pumps are each driven by 25/65-horsepower motors through V-belts.

A concrete wall completely surrounds the location, and within it and below the derrick floor is the mud-circulating system. The settling ditch takes the returns from the well and passes the mud around the confined area and into the suction pit below the pumps. The pumps are staggered in order to provide room for servicing them and the motor.

When drill pipe is added or when casing is run, it has to be brought in by truck piece by piece, since there is no room for any pipe storage whatever. This slows the operation up considerably, but the well is making hole in good time and the crowded conditions do not seem to interfere with drilling to any great extent.

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## Correction

In a recent issue of *The Petroleum Engineer* it was erroneously stated that the Hope Engineering Company was merged with the Cooper-Bessemer organization in 1928.

In 1928 the Hope Engineering Company sold to the C. & G. Cooper Company its manufacturing plant located in Mt. Vernon, Ohio. The Hope Company still represents the C. & G. Cooper Company, now the Cooper-Bessemer Corporation, in the sale of the latter's equipment.

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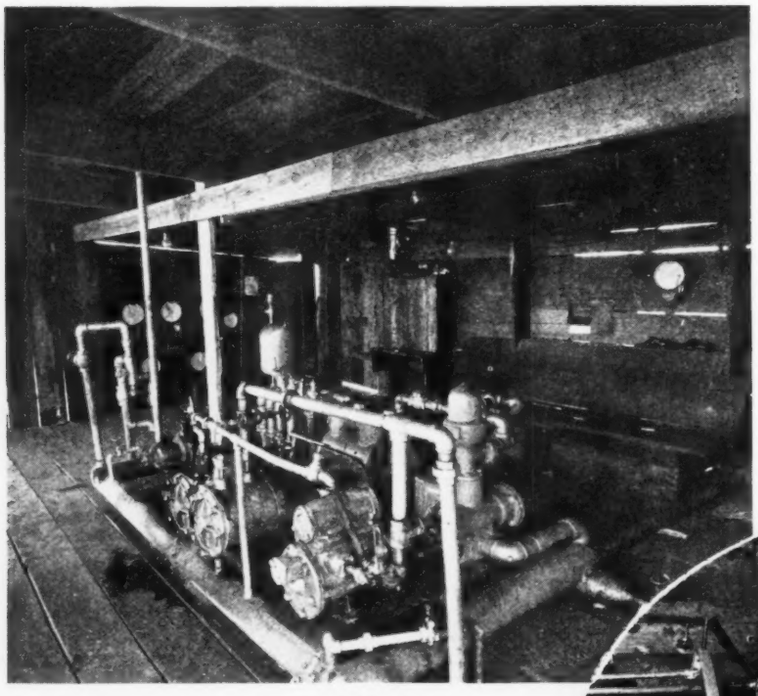
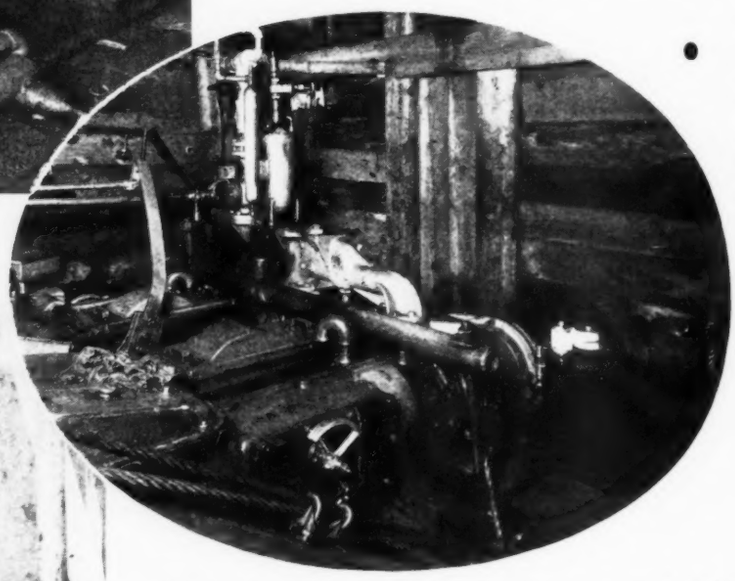
# A. S. M. E. Making Steam Rotary

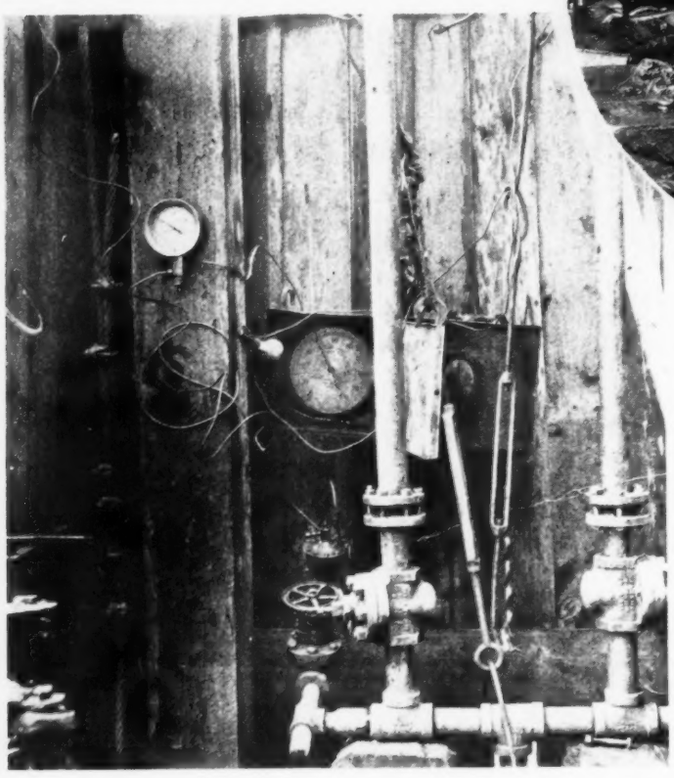
ONE of the major projects of the Mid-Continent Section of the American Society of Mechanical Engineers is the test of steam equipment for rotary drilled oil wells which is being conducted on I. T. I. O. Lemmon No. 3, SW SW SE 11-11-3-W, Oklahoma City Field. The test is being conducted on the boilers and prime movers to determine the overall efficiency and power requirements for the various drilling operations. With these data available the oil industry will have a definite basis with which to work toward more economical drilling with steam power. Ultimately the A. S. M. E. hopes to obtain similar information for all types of prime movers for this service.

This test comes under the production committee, the general chairman of which is D. L. Trax, with R. M. Carr, chairman of the steam sub-committee. The work of organizing and conducting the test has been done by W. H. Carson, director of the School of Mechanical Engineering, University of Oklahoma, assisted by the faculty and students of the Mechanical Engineering School. The engineers of the I. T. I. O. Company and the Schoenfeld & Hunter Contracting Company have co-operated to the fullest extent. In setting up equipment for a test of this kind there are many unforeseen things which will arise, but with an interested contractor and willing crews, most of the unforeseen obstacles can be overcome in a short time. The testing apparatus has been so arranged that it does not interfere with the regular routine of the crews in any of their operations.





Above—Interior of boiler house, showing boiler feed pumps. Right—Engine house, showing indicator card mechanism. Below—Weight-recording apparatus on the derrick floor.

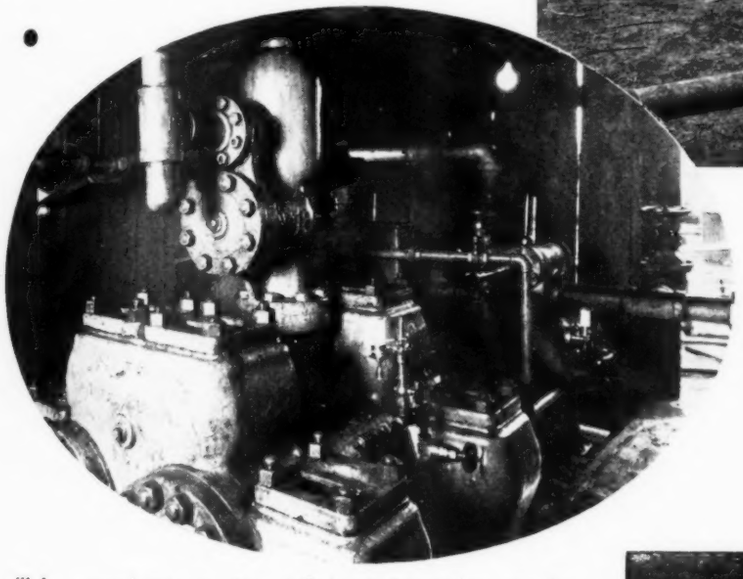


The apparatus used is as follows: A master water meter for metering all water going to the location; a gas meter; a water meter in the feed-water line; a steam flow meter to the auxiliary equipment, such as feed-water pumps and generator turbine; two steam flow meters in the line to the drilling engine; one steam flow meter in the line to the mud pumps; recording steam pressure gauges; separating and throttling calorimeters; Orsat apparatus; four continuous-diagram steam-engine indicators; two non-continuous-diagram steam indicators; four stroke counters; one tachometer; stop watches, and other miscellaneous equipment. All of the equipment for measuring the

# Observations *on* Drilling Rig

flow of steam, water, gas, as well as the tachometer and pressure gauges, are of the recording type. The indicators and steam calorimeters are the only equipment that will require personal attention when operating.

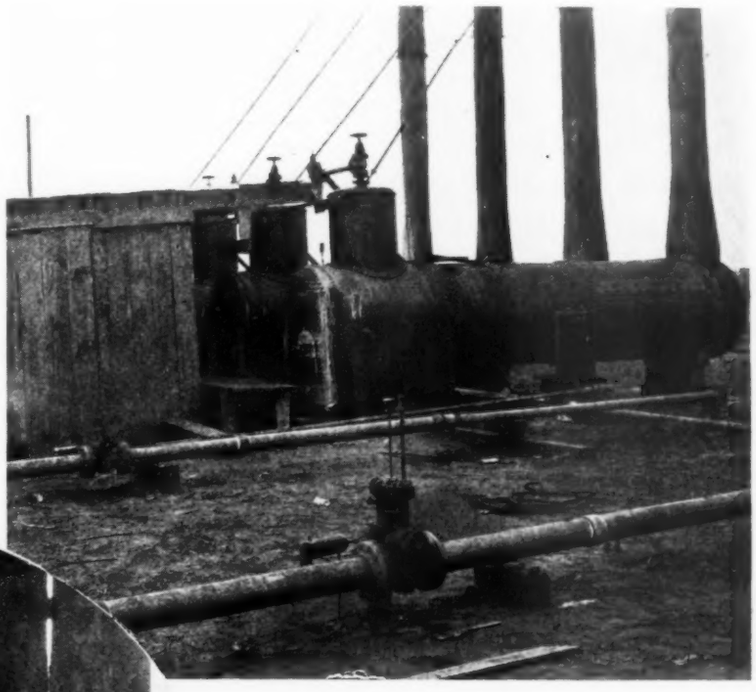
It will be noted that two steam flow meters are used in the line to the drilling engine. These meters are placed in series, one of them having a 24-hour clock, the second a 2-hour clock. The second meter is used during the operation of pulling the drill pipe out of the hole. During this time the steam demand for the drilling engine varies from zero to a maximum over a short interval of time. When this is recorded on the 24-hour clock the entire operation will show up as a complete blur of ink, but the record on the chart of the 2-hour clock will be spread out so that definite information can be determined from it.

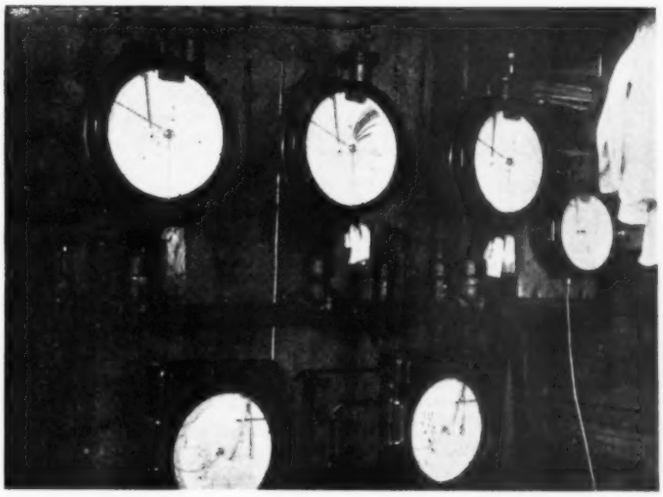


The manufacturers of the various types of apparatus that are on this test have been liberal in loaning equipment.

Indicator cards are being taken on the drilling engine and the mud pumps. This includes both the steam and mud cylinders on the pump. Cards are also taken when raising the drill pipe out of the hole. These are taken with a continuous-diagram type indicator. A log of the well is being kept and the power requirements to drill through the various formations will be determined. Another interesting comparison will be the horsepower required to lift the drill pipe and bit through the various formations as compared with the theoretical horsepower necessary to lift a weight equivalent to the drill pipe and bit. The crookedness of the hole will also have a bearing on the horsepower requirement, which will be plotted on the depth scale as well as the formations encountered.

Some very interesting results are being obtained from the mud pumps, since simultaneous readings are being taken both on the steam and mud end. To the knowledge of Prof. Carson this is the first time that cards have been taken on the mud end when the pump was actually in operation in the field. With the indicating and recording pressure gauge connected to the mud line on the derrick floor, comparative pressure drops are being determined. An attempt is also being made to measure the quantity of fluid entering the pump. This is being worked out at the writing. The principle used is the Pitot tube method, and the preliminary results are checking satisfactorily with what might be expected of a pump with a given speed and stroke.





**Above—Boilers showing orifice installations for measuring steam input. Left—Slush pumps showing indicator card mechanism. Below—Panel board showing pressure and temperature recording instruments.**

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## Popular Sinclair Executive Dies

R. A. Griffith

RICHARD ASBURY GRIFFITH, president of the Sinclair Oil & Gas Company, died October 24th in New York City from double pneumonia. His death came after two years of failing health. He had been a patient at Doctors Hospital, New York, for several days before his death. After arriving there for special treatment, he seemed to sink slowly.

Mr. Griffith, or Berry, as he was called by his friends and acquaintances, was an important figure in the oil business and one of its most highly esteemed officials. Modesty, kindness and good fellowship were attributes by which Mr. Griffith will long be remembered.

Mr. Griffith was born in the oil country at Bradford, Pa. His father was a veteran oil man of Pennsylvania. Mr. Griffith first came to Tulsa in 1908 as tool salesman for the Oil Well Supply Company. His capacity for work and ability to make friends made him popular and successful. He became district manager of the Continental Supply Company when that concern was organized.

He served this company until the Sinclair Oil & Gas Company was organized in 1916, at which time he became head of the land department. He was made vice-president in 1919 and, upon the death of E. Rogers Kamp, was promoted to the presidency, the position he held at the time of his death.

His continued illness followed an attack of influenza in 1928. Despite the urgings of friends for him to take things easier, Mr. Griffith continued to devote most of his time to his business. Outside of his flower garden in the rear of his home at Tulsa, he had no hobbies.

He is survived by his widow; a son, R. A. Griffith, Jr.; a brother, C. E. Griffith, all of Tulsa, and a sister, Mrs. Joseph Bovaird, of Bradford, Pa.

Funeral services were held in Tulsa and the body was put to rest in the mausoleum at Rose Hill cemetery.

Prominent oil men, civic leaders and others with whom Mr. Griffith was in contact in his wide activities were pallbearers.

## How Many Revolutions Per Minute?

*By* **W. F. Schaphorst, M. E.**

I HAVE hit upon a handy kink for checking revolutions per minute by simply listening to the tick of my watch and at the same time watching the rotating member of the machine that is being checked.

For example, my dictating machine is supposed to rotate at the rate of 100 r.p.m. I hold my watch to my ear and know that the wheel of the dictating machine should make one r.p.m. every time the watch ticks three times.

Most watches tick 300 times per minute. Therefore, by means of your watch, you can easily check anything that must rotate 300, 200, 100, 50, or 30 times per minute, or any other number of times divisible into 300. Try it and you will agree that it is very easy.

For an odd number of r.p.m., not divisible into 300, a pendulum can be made quickly by tying a weight onto the end of a cord. Suspend the weight and experiment with the length of the cord until it is "just right," giving you as many oscillations per minute as there should be r.p.m. Then fasten the cord at that length. You now have a permanent gauge for checking up the r.p.m. at any time. You can do your checking in a few seconds whereas by other methods that are commonly used it usually takes much longer.

## Republic Steel Opens New Offices

THE Republic Steel Corp. has opened a district sales office in Tulsa, Okla., with C. S. Powers in charge as district sales manager, it is announced by Norris J. Clarke, vice-president in charge of sales of the corporation. Mr. Powers formerly was connected with the Republic sales office at Detroit.

The Tulsa district will include the state of Oklahoma and a portion of Kansas.

## Welding Engineering Co. Awarded New Contracts

THE Welding Engineering Company of Bartlesville, Oklahoma, announces that it has been awarded contracts for electric welding two additional sections on the Continental Construction Corporation's 24-inch Line from Amarillo to Chicago, as follows:

Section No. 1—fifty miles in the Texas Panhandle—general contractors, Sheehan Pipe Line Construction Company. Section No. 5—one hundred thirteen miles in Iowa—general contractors, Henry L. Lemons, Inc.

With the contracts previously awarded, this makes a total of three hundred and three miles of electric welding awarded to the Welding Engineering Company on this line.

## Contest Concerning Bettis Protectors

OFFERING a total of twenty cash prizes ranging from $5.00 to $200.00, the manufacturers of Bettis Protectors are staging a contest that is expected to create widespread interest in the oil industry. It is the desire of the manufacturers to obtain expressions regarding the service of their product in various fields. They are holding the contest for the purpose of obtaining letters. A brief, well-written letter is all that is required to become an entrant in the contest. The letters are to set forth the experience of the writers in the use of Bettis Protectors in oil well drilling. A total of $400.00 is to be awarded and the contest will close December 31st. Entrants should forward their letters to the Patterson-Ballagh Corporation, Insurance Exchange Bldg., before that time. A special bonus of $5.00 will be given for each photograph of Bettis Protectors sent in to the contest committee that is accepted by them and this payment will be made regardless of letters that might be submitted.

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Have a cool supply of clean-pure sparkling water... ready to drink at all times. No matter where you are the GOTT Water Can is health insurance. Your supply store has them.
GOTT Water Cans 1½ gal; 3 gal; 5 gal; and 10 gal.
GOTT Water Coolers 3 gal; 5 gal; 8 gal; 10 gal; and 20 gal.
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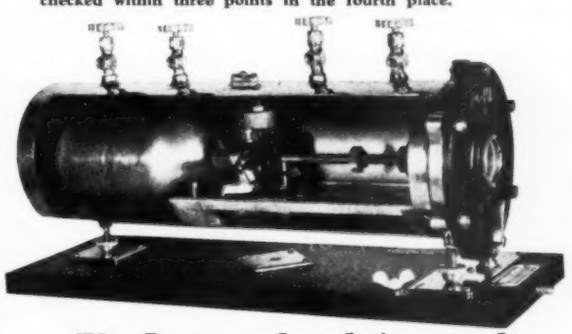
***So Accurate That—***

**when properly operated it will give results that can be checked within three points in the fourth place.**



***The Improved and Approved AC-ME Gas Gravity Balance***

**This device, one of our complete line of scientific ACcurate-MEasuring equipment, is also portable, and is completely equipped with essential needle valves and a carrying case. Constructed to meet specifications required under various conditions, both in the field and in the laboratory. Dependable results on wet or dry gas—natural or artificial.**

**This is the Four Spring Type recommended by Bureau of Standards, and this device has been adopted by the Natural Gasoline Association.**

**Send for descriptive folder "P"—also Bulletin 15-P, showing our complete line of Scientific AC-ME equipment.**

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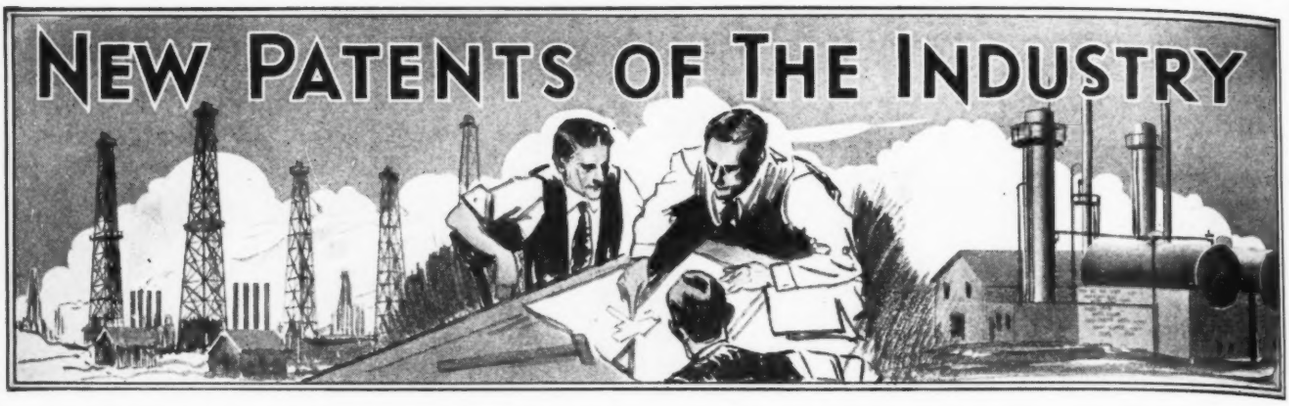
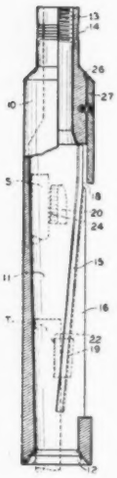
**Los Angeles, Calif.**

# NEW PATENTS OF THE INDUSTRY



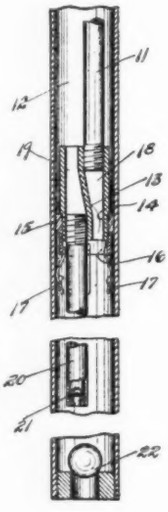


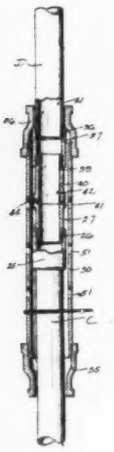
1,778,968. COMBINATION ROD AND TUBING FISHING TOOL. CHARLES A. TOWNE, Tulsa, Okla. Filed Nov. 20, 1929. Serial No. 408,586. 7 Claims. (Cl. 294—102.)

1. A fishing tool consisting of an integral, cylindrical, elongated, open-sided socket member having ridges near its upper end and having a bore therethrough, said bore being doubly flared at its lower end, interiorly threaded at its upper end and connecting with the aforesaid side opening, undercut grooves formed in the walls defining said bore and extending in upwardly diverging relationship to the axis of said bore until they emerge through the open side of the socket member, a gripping device having lugs thereon adapted to be inserted into the undercut grooves and detachable means adapted to be fastened to the socket member to prevent egress of the gripping device.

1,778,723. PUMP. FRED M. OEDER, Flint, Mich. Filed Aug. 14, 1929. Serial No. 385,724. 1 Claim. (Cl. 103—164.)

A liquid pump comprising a casing, having a check valve on the lower end thereof, a plug mounted in said casing and having a shouldered threaded end, a packing mounted thereon, an interiorly threaded tubular shoe having threaded engagement with said threaded end for expanding said packing to form a leak-proof joint with the casing, resilient fingers secured to said shoe and frictionally engaging the casing passages in the plug, one end of each passage being threaded and adapted to receive an air line and a discharge pipe respectively, the opposite ends being arcuate shaped, said discharge pipe projecting downwardly into the casing and having a check valve in the lower end thereof, and means for alternately creating a suction and pressure in the casing below the plug, for sucking water into the lower end of the casing and exhausting water from the upper end thereof.



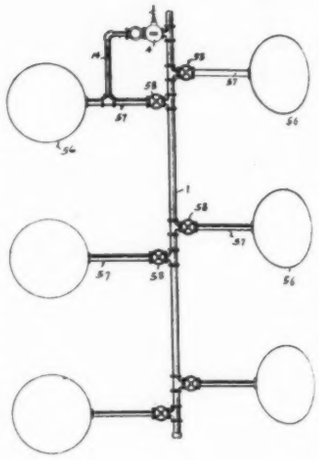


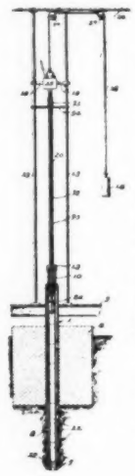
1,778,740. OIL-WELL FLOODING APPARATUS. NELSON E. WIGHTMAN, Bolivar, N. Y. Filed May 7, 1924. Serial No. 711,709. 3 Claims. (Cl. 166—21.)

1. Apparatus of the class described consisting of upper and lower pipe sections, valve parts carried by said upper and lower pipe sections in a facing relation which will relatively abut when the sections are moved toward each other to provide a ground joint connection, and coupling means movably connected with both the upper and lower pipe sections including a perforate sleeve.

1,779,260. PIPE-LINE SIGNAL. HENRY G. MOBLEY, Houston, Tex. Filed June 29, 1926. Serial No. 119,318. 4 Claims. (Cl. 137—78.)

4. A device of the character described including a plurality of containers, a main line, branch lines connecting the respective containers into the main line, an electrical circuit, a source of electrical energy and an annunciator connected into said circuit, a switch for completing and breaking said circuit and means arranged to be actuated by the fluid flowing from the main line into one of said containers and effective to close said switch.



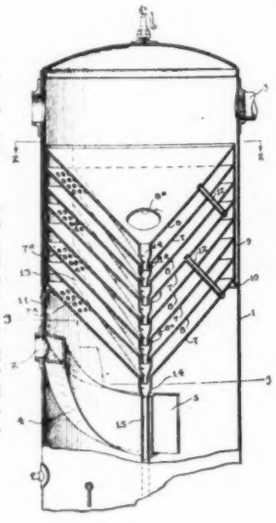


1,779,161. WORKING-BARREL HONING DEVICE. ROY DOUGLAS, Mexia, Tex., assignor of one-fourth to Associated Factories Corporation, Dallas, Tex., a Corporation of Delaware. Filed June 30, 1928. Serial No. 289,553. 8 Claims. (Cl. 51—34.)

1. A working barrel honing device comprising a stationary work holder, means at the lower end of said work holder for centering the working barrel and its associated liners within the work holder, means at the upper end of said work holder for centering the working barrel and its associated liners within the work holder and for maintaining the working barrel against rotary or vertical movements therein, a rotary reciprocating tool suspended above the work holder and in vertical alignment therewith and adapted to operate on said liners to grind or hone the same to a predetermined internal diameter, a vertical guide standard positioned above the stationary work holder, and a guide bar associated with the tool and engaging the standard for guiding the said tool during its reciprocating movements.

1,779,023. OIL AND GAS SEPARATOR. MILLARD F. WATERS, Tulsa, Okla., assignor to Smith Separator Company, Tulsa, Okla. Filed Dec. 26, 1928. Serial No. 328,563. 5 Claims. (Cl. 183—2.7.)

1. In an oil and gas separator tank, a series of superposed conical baffles spaced apart and provided with perforated and imperforate sections, said baffles being alternately arranged so that the perforated sections of each baffle are adjacent the imperforate sections of the next occurring baffle, and a substantially vertical wall extending through a portion of said baffles for sealing the spaces therebetween and preventing direct communication between the perforated sections of adjacent baffles.



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Necessary relief of excess discharge pressure is made sure and safe for the compressor operated at constant speed. . . . On low pressure gas compressors, constant discharge is held without affecting pressure of supply main, regardless of differential between main and discharge pressures. . . . Equally successful for steam as a back-pressure regulator. . . . Only means for close regulation of uniform pressure on electric-driven pumps. . . . Applicable for gas, air, steam and water.

The valve has a definite positive movement for a definite change in discharge pressure, and will remain indefinitely at some intermediate position between the wide open and closed position.

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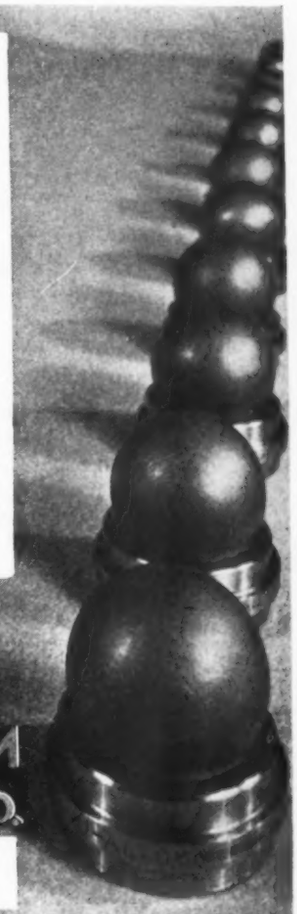

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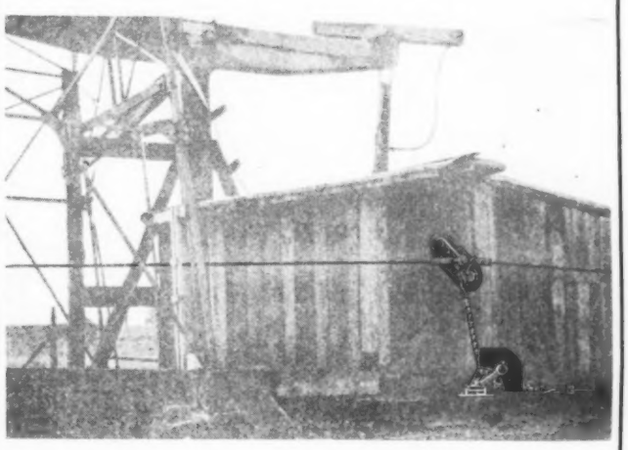
BEGINNING ON PAGE 40 and running in sequence are the new editorial features presenting in concise form major developments in the producing, refining and pipe line branches of the industry. These features, well illustrated with color maps and charts, will appear regularly in relatively the same location, affording a source of reliable information which on account of the manner of presentation may be easily assimilated.

THE PETROLEUM ENGINEER



## Coles Standard Rig-Power Unit

Converts rig into balanced power. Down-pull Grip prevents cross pulls from racking rig and keeps shaft in place. Rod line thru power deflector can take off at any angle.

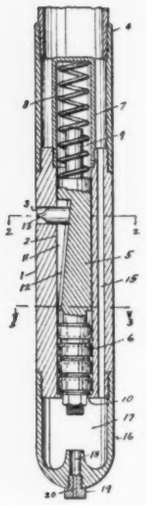


*This picture is of an actual installation, pumping four 3,500-foot wells, all at the same time, with a 25 H.P. Gas Engine.*

*Export Agent:* Oilfield Equipment Co., New York

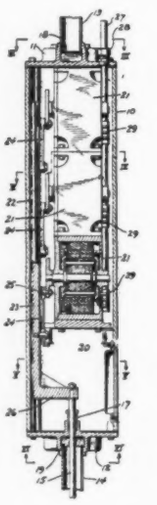
THE PRODUCING EQUIPMENT CO.

TULSA OKLAHOMA



1,772,710. INSIDE PIPE CUTTER. HARVEY J. DENNEY, West Lake, La. Filed June 1, 1928. Serial No. 282,183. 2 Claims. (Cl. 81—195.)

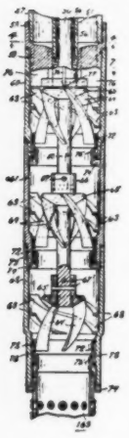
2. A casing cutter having a cylinder and a pressure chamber at one end of the cylinder, a mandrel in the cylinder, one end of which is exposed to the pressure of fluid in such chamber, a radially movable cutter operatively connected with the mandrel, an operating string to the lower end of which the cylinder is attached, there being a fluid channel leading from within the string and terminating in said chamber, a yieldable member normally resisting the upward movement of the mandrel and means in the stem attached to the upper end of the cylinder and enclosing said yieldable member and excluding the pressure fluid from the upper end of the mandrel.



1,772,539. OIL-WELL PUMPING EQUIPMENT. EDWARD C. EKSTROMER, San Francisco, Calif., assignor, by direct and mesne assignments, of one-half to James F. Gallagher, Boston, Mass., and one-half to The Edward C. Ekstromer Corporation, Reno, Nev., a Corporation of Nevada. Filed Apr. 2, 1928. Serial No. 266,470. 5 Claims. (Cl. 74—14.)

1. In an electrical drive for oil well pumps and the like, the combination of a reciprocating driving rod adapted to be connected with the sucker rod of a pump and a plurality of electric motors arranged along said driving rod and connected thereto through suitable means whereby a reciprocating movement will be imparted to said rod as said motors rotate continuously in one direction.

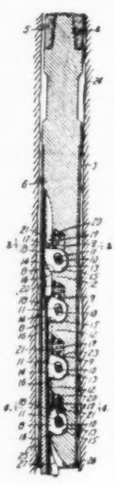
1,772,525. TURBINE PUMP. GEORGE W. SLOCOMB, Los Angeles, Calif. Filed Mar. 19, 1928. Serial No. 262,796. 6 Claims. (Cl. 193—90.)



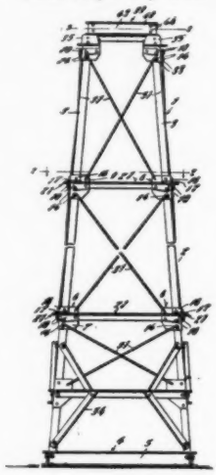
1. A turbine pump including a stationary vertical cylinder spiral blades secured to the inner wall of said cylinder and encircling a rotor, said rotor comprised of a hub with helical blades curved reversely to the spiral blades and extending downwardly from and connected to the lower part of the hub by their upper ends only and supported centrally in said cylinder, a ring secured to and surrounding the lower parts of the rotor blades, said ring fitting closely but loosely in said cylinder and adapted to rotate immediately below the spiral blades to stabilize rotation, and means for supporting and rotating said rotor.

1,775,291. FISHING TOOL. WILLIAM E. NILES, Kansas City, Mo. Filed Oct. 15, 1928. Serial No. 312,415. 10 Claims. (Cl. 224—97.)

1. A fishing tool of the character described, comprising a body having a plurality of recesses and curved seats in the recesses, tool engaging members movably mounted in the recesses, said seats limiting the movement of said members, and means engageable with a tool adapted to be recovered by the device for enforcing the engagement of said members with the tool.



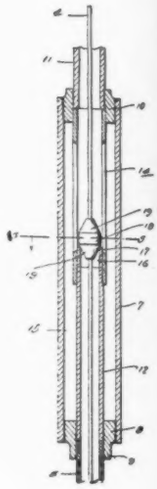
1,772,822. DERRICK CONSTRUCTION. HOWARD E. WHITE, Holdenville, Okla., assignor of one-half to Harry R. Allen, Holdenville, Okla. Filed Sept. 10, 1928. Serial No. 304,964. 2 Claims. (Cl. 189—11.)



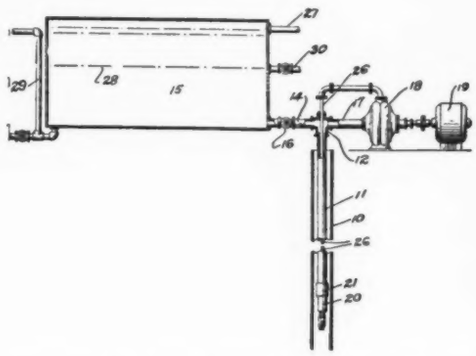
1. In a derrick, a plurality of superimposed sections forming corner posts, spaced inner and outer angular plate members secured on the upper ends of each corner post, the upper portions of said angular plate projecting above the upper end of each corner post, the lower end of the superjacent section having interfitting relation with the angular plate members, the adjacent edges of said superimposed sections having abutting engagement, girts connecting the corner posts of each section together, and means for locking the girts in place, said locking means including an angular plate secured on the outer face of the lower end of the superjacent section adapted to engage the top of the adjacent girt.

1,772,946. SAND AND SCALE TRAP. SAMUEL L. HIRST, Beeville, Tex. Filed Oct. 10, 1928. Serial No. 311,610. 1 Claim. (Cl. 103—220.)

A sand trap for pumps comprising in combination, a barrel adapted for interposition between two sections of a well tubing at a point above a pump cylinder, a pump rod extending operatively and centrally through the barrel, a sectional shell arranged centrally in the barrel through which the pump rod extends, said shell being spaced from



1,771,988. APPARATUS FOR EXHAUSTING WELLS. CHARLES A. ANDERSON, Oakland, Calif. Filed Mar. 12, 1928. Serial No. 260,900. 3 Claims. (Cl. 103—260.)



1. An apparatus for lifting liquid from deep wells comprising a pump, a pump tube extending downwardly into the well below the fluid level therein, an injector pipe connected to the discharge port of the pump and extending downwardly through the pump tube, a cylindrical nozzle head threadedly connected to the lower end of the pump tube, said nozzle head having an intake passageway to which the injector pipe is connected, a plurality of upwardly projecting nozzles in communication with the intake passageway, said head being formed with a plurality of vertical passageways forming communication between the interior of the pump tube and the well, said nozzles being in vertical alignment with said vertical passageways and positioned below the same with their upper ends closely contiguous to the lower ends of said passageways whereby fluid pumped downwardly through the injector pipe will pass through the nozzles into said passageways under high velocity to cause the fluid in the well to be lifted in the pump tube.